

PM TRADE Industry Standards Working Group

31 March – 2 April 2015



Rob Wolf
PM TRADE
Strategic Requirements Integrator
31 March 2015



Interfaces Standards IPT MAR 2015 Agenda



Tuesday – 31 March, GDC4S, 12001 Research Parkway, Ste. 500 (5th floor) Orlando, FL 32826

- **0900 - 1100 LT2 TESS Working Group Final Products Overview – Rob Wolf**

- WG Final Products & Implementation: Component Architecture, LPAN, LTEC, Common Message
- LPAN/LTEC Demo Overview & WG member components
- LT2 TESS Developers Kit and Kit Check-out Procedures
- WG Re-Start Discussion & Vision

Overview to Facilitate Current and Future New Business Opportunities

- **1300 – 1630 LT2 TESS LTEC/LPAN Demo - LT2 LPAN/LTEC Team**

- LTEC version status update and lessons learned (version 1.2 to 1.2.1)
- LT2 TESS LPAN/LTEC Demo with Q&A

**Future IPT WG meetings
will resume after VTESS
contract award**

Wednesday - 1 & 2 April 0830-1600

- LT2 LTEC Software Developers Course (RSVP required)
- LT2 TESS Component Developer Kit Check-out lottery (take kit that day – 5 available)

Note: LTEC courses will continue on a periodic basis to support other PM TRADE initiatives





LT2 TESS Standards Journey



Exactly 24 months ago this week (2 April 2103) was our kick off meeting in PIII 321

Special thanks to
our Industry
partners that
remained
committed to
helping us shape
the future LT2
TESS Standards



- 1) 2 APR 13
- 2) 3 MAY 13
- 3) 11 JUN 13
- 4) 13 AUG 13
- 5) 22 APR 14
- 6) 3 JUN 14
- 7) 19 AUG 14
- 8) 14 OCT 14
- 9) 31 MAR 15



**WG established the foundation
architecture for LT2 TESS**



PM TRADE TESS Evolution / Vision Slide

MILES TESS Configurations

Key Interfaces

Communications (Instrumentation Radio)

**Circa
1980-2002**



Vendor Specific
Closed Systems

MILES Code Standard

Non Instrumented
Initially then Custom
Radio Interfaces

**2002 -
2012**



Vendor Specific
Closed Systems With
Custom Radio Interfaces

- ✓ MILES Code upgrades
- ✓ TESS Radio Interface
- ✓ PAN in Development

- ✓ Radio TESS Interface
Standards – Compilation
- ✓ LT2 Gateway

Component Based Acquisitions
Open Published Interfaces and Perf. Stds.

**Near Term
Vision
(2013-2020)**



- ✓ Supported Standards
 - RS-232
 - 802.15.4 (PAN)
 - USB
- ✓ Common Message Format
- ✓ Connections & Interfaces
- ✓ Power Interface
- ✓ LTEC SW (TESS/BDA)

- ✓ Published Interfaces
- ✓ Common Message Set
- ✓ LTEC TESS Logic &
RTCA/BDA SW
- ✓ Remote CM Services
from IDE.
- ✓ *Tactical Radios/Systems
Supporting some Training
capabilities*

**Long
Term
Vision**

Training functionality Embedded as part of
tactical weapon/radios. -- Individual Soldier
and Weapon System
computer/displays/optics...

Developing & Managing Training Software Applications and
Weapon/Radio/Soldier Computer Interfaces/firewalls to Push and
Pull data driving Stimulations (*effects, graphics, audio, simulated
C4ISR communications, real time coaching...*)

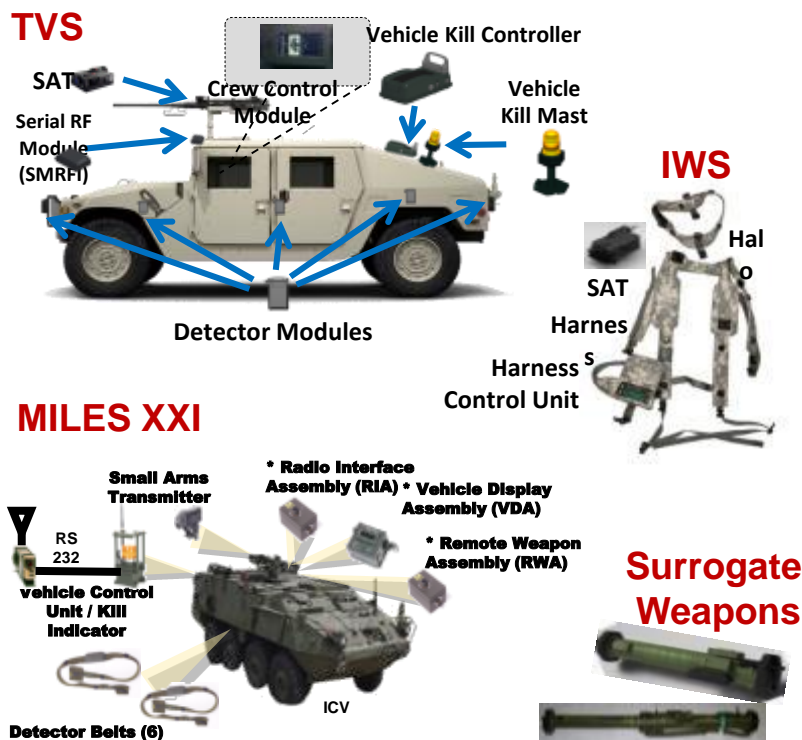


PM TRADE is Transitioning to Component Architecture TESS Product Line



Previous Acquisitions

Vehicle-TESS acquisition strategy will shift from acquiring contractor specific platform configurations every 5 years to acquiring common components that can be used across a variety of platforms.



Future Acquisitions

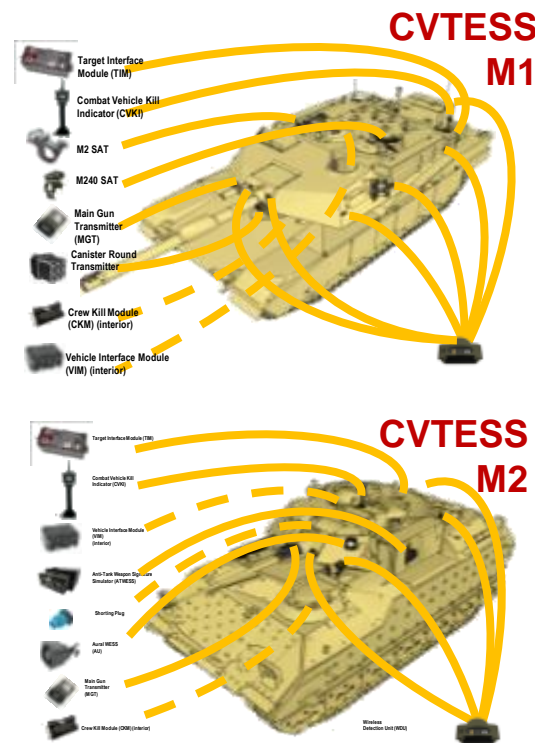
Baseline Component Functionality derived from previous program common denominators

Primary Components:

- Master Controller
- Laser Detector
- Laser Transmitter
- Signature Devices
- Crew Interface
- Power Supply
- Surrogates
- Weapon Interface
- System Set-up Tool

Primary Interfaces:

- PAN
- USB





Component Architecture Enables Migration to Embedded / Hybrid Training and Future Components



Appended Dismount



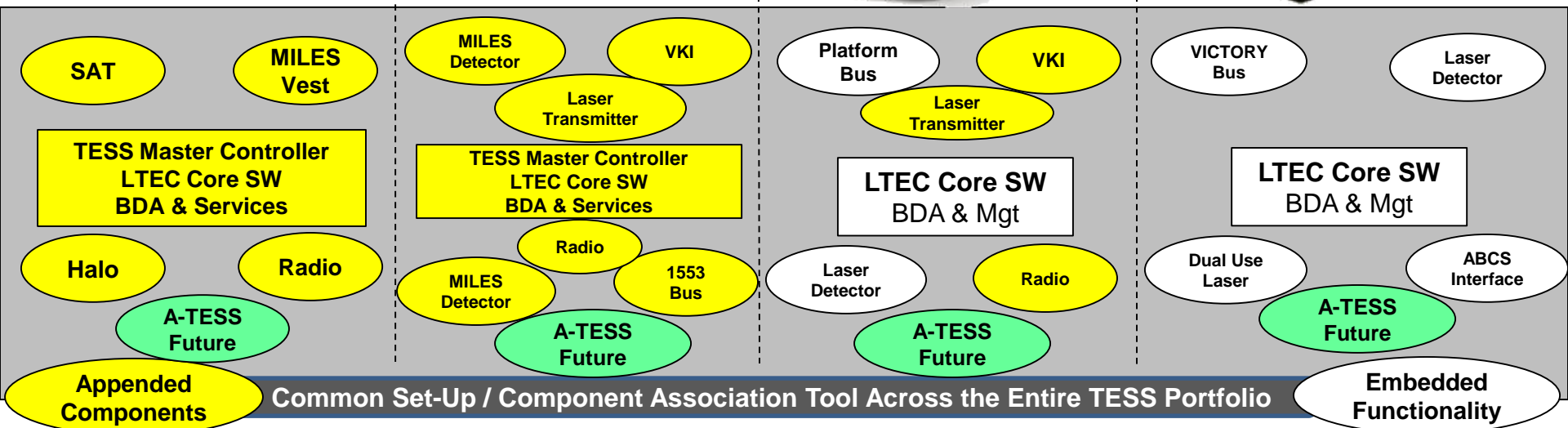
Appended Platform



Appended/ Embedded Hybrid



Embedded Platform



Interface Standards Management is key to program success

- Master Controller with Gov't LTEC SW manages BDA and Component Network
- Common System Set-up tool provides menu driven CM and component associations
- Active Configuration Management Program to remotely manage new product implementations, LTEC and Product SW upgrades, documentation and manual revisions,





Component Architecture Road Map Starting Reference (from 2 April 2013 briefing)



CTIS/DT ExCon

Interfaces with Training Exercise Area via Gateway >>> Migrate to Common Message Format.

Common Message Structure independent of carrier or radio

CTIS/DT Network Radios

Communicate with LTS family of products and other devices via the PAN or published wired interface.

O/C Tablets

FO Tablets

???

802.15.4 PAN

Wired interface supporting RS-232 and USB

PM TRADE Family of Systems and Components

Communicate with one another via PAN or published wired interface.

SAT

IWS

Detector

CVKI

Main Gun LT

?

IED

Indirect Fire

???

?

OneTESS

Vest

Mine Simulation

Battlefield Effects

Medical

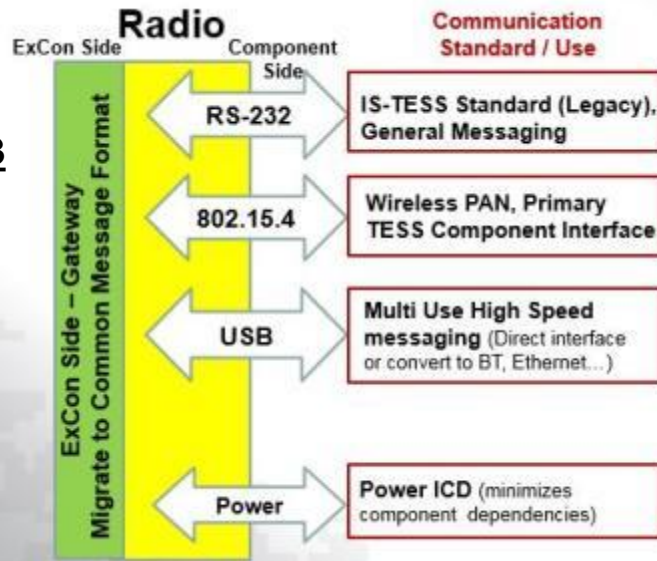




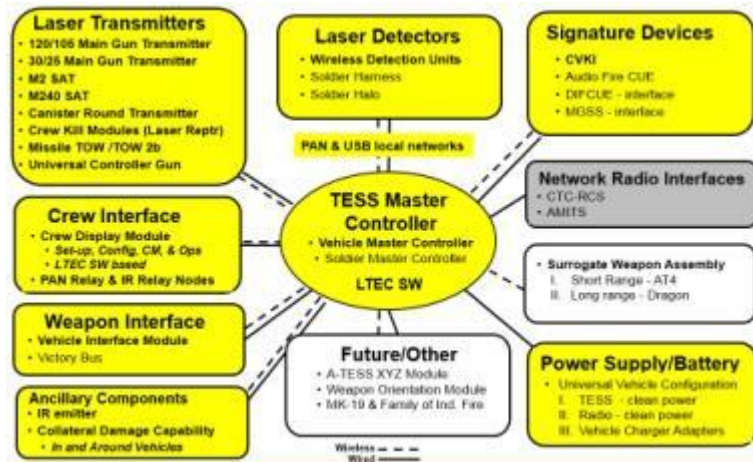
Component Architecture Functional Evolution



APR 2013

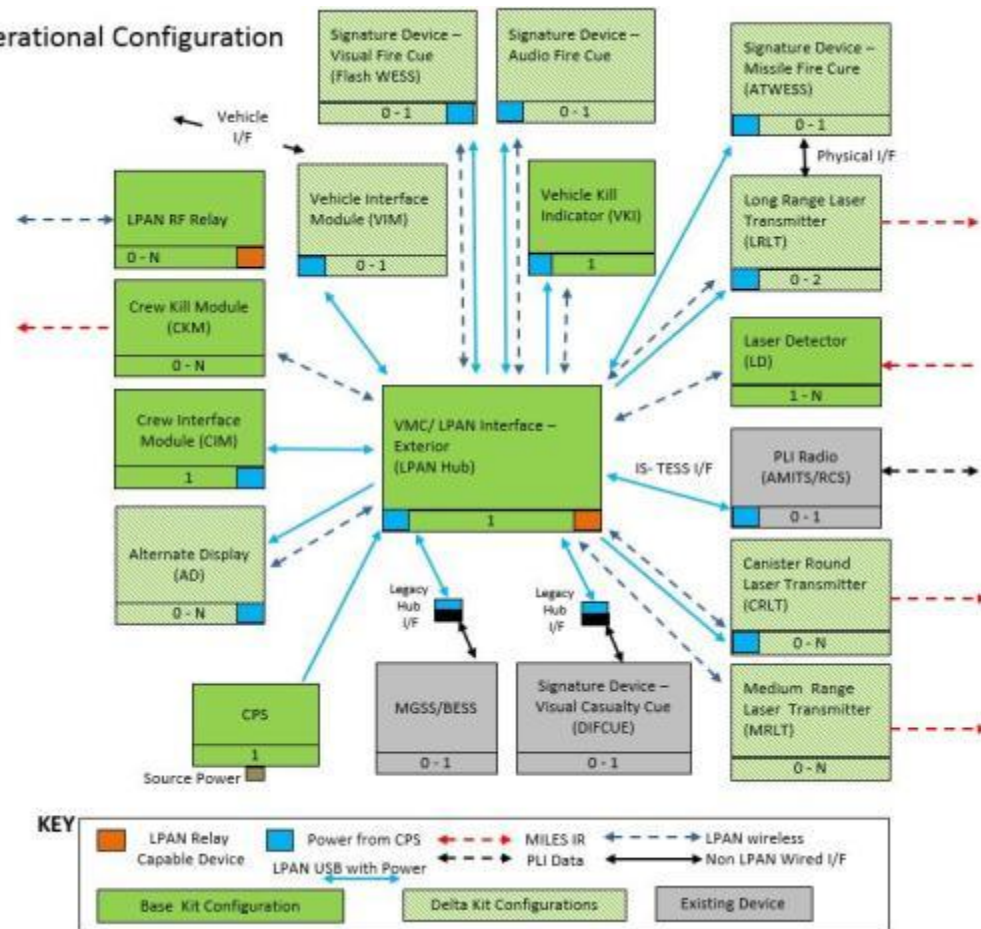


APR 2014



Current State: 17 MAR 2015

Operational Configuration





Functional Configuration

The diagram illustrates the functional configuration of the Vehicle Interface Module (VIM) and its connections to various systems. The VIM is the central component, represented by a green box with a blue bar at the bottom labeled '0-1'. It is connected to several other modules:

- Signature Device – Visual Fire Cue (Flash WESS):** Connected to the VIM via a blue bar labeled '0-1'.
- Signature Device – Audio Fire Cue:** Connected to the VIM via a blue bar labeled '0-1'.
- Signature Device – Missile Fire Cue (ATWESS):** Connected to the VIM via a blue bar labeled '0-1'.
- Vehicle Kill Indicator (VKI):** Connected to the VIM via a blue bar labeled '1'.
- Long Range Laser Transmitter (LRLT):** Connected to the VIM via a blue bar labeled '0-2'.
- Laser Detector (LD):** Connected to the VIM via a blue bar labeled '1-N'.
- PLI Radio (AMITS/RCS):** Connected to the VIM via a blue bar labeled '0-1'.
- Canister Round Laser Transmitter (CRLT):** Connected to the VIM via a blue bar labeled '0-N'.
- Medium Range Laser Transmitter (MRLT):** Connected to the VIM via a blue bar labeled '0-N'.
- Signature Device – Visual Casualty Cue (DIFCUE):** Connected to the VIM via a blue bar labeled '0-1'.
- MGSS/BESS:** Connected to the VIM via a blue bar labeled '0-1'.
- CPS:** Connected to the VIM via a blue bar labeled '1'.
- Alternate Display (AD):** Connected to the VIM via a blue bar labeled '0-N'.
- Crew Interface Module (CIM):** Connected to the VIM via a blue bar labeled '1'.
- Crew Kill Module (CKM):** Connected to the VIM via a blue bar labeled '0-N'.
- LPAN RF Relay:** Connected to the VIM via a blue bar labeled '0-N'.

The VIM is also connected to a **Vehicle I/F** (Vehicle Interface) and a **Physical I/F** (Physical Interface). The diagram shows various types of connections, including solid blue lines, dashed blue lines, and red dashed lines, indicating different levels of integration and data flow.

Diagram illustrating the connection between the Base Kit Configuration, Delta Kit Configurations, and Existing Device:

- Base Kit Configuration** (Green box) is connected to **Delta Kit Configurations** (Yellow box) via **LPAN USB with Power** (Blue arrow).
- Delta Kit Configurations** are connected to **Existing Device** (Grey box) via:
 - MILES IR** (Red dashed arrow)
 - LPAN wireless** (Blue dashed arrow)
 - Non LPAN Wired I/F** (Black solid arrow)

Legend:

- Orange square: LPAN Relay Capable Device
- Blue square: Power from CPS
- Red dashed arrow: MILES IR
- Blue dashed arrow: LPAN wireless
- Black solid arrow: Non LPAN Wired I/F
- Blue solid arrow: LPAN USB with Power
- Black dashed arrow: PLI Data



LT2 TESS Hardware Component Agreements

Current Set of HCA and related documents in various state of completeness.

- Documents need completing
- Additional documents to be added to provide a complete set of HCAs, ICDs, and LTEC/LPAN SW services to include verification and testing
- All components and controlled/fabricated products need a HCA for future configuration management and future acquisition at the functional/operational level
- Documents will be individually and independently verified: HW, SW, ICD
- Draft Documents are Located in the 'MILES VTESS' collaboration area on LT2 Portal

	Component HCA / ICD
1	Canister Round Laser Transmitter
2	Medium Round Laser Transmitter
3	Long Range Laser Transmitter
4	Crew Interface Module
5	Laser Detector
6	Vehicle Interface Module
7	Vehicle Kill Indicator
8	Vehicle Master Controller
9	Crew Kill Module
10	LPAN RF Relay
11	Alternate Display
12	Visual Fire Cue
13	Audio Fire Cue
14	Missile Fire Cue
15	Common Power Supply
16	Cables, Connectors, and Routing
17	Bus Interface Module
18	Family of Consumable Batteries
19	Software Support Environment
20	PRF-PT-00647 Environmental, Construction, Safety, and E ³ Requirements Specification
21	PRF-PT-00549 LPAN Standard
22	LPAN Component Message Sets
23	LPAN Interoperability Enumeration Document
24	Live Training Transformation (LT2) Tactical Engagement Simulation System (TESS) Component Architecture Foundation Overview
25	PRF-PT-00608 LTEC ICD
26	Others to support End-to-End functionality???





CA Functional Modes of Operation



Components defined in HCAs, will have four modes of operation:

- 1) **Component set-up and association mode.** This mode enables individual components to be associated with other components to instrument a given weapon system or soldier. Associations may be hard (locked) or soft (dynamic) based on the component and its application on the battlefield. Verifies Component SW CM version before install.
- 2) **Operational mode.** This is the mode used during the tactical training exercise to enable force-on-force, force-on-target, or infrastructure configuration to support combined arms engagement training.
- 3) **Disassociation and reset mode.** Used at end of exercise to baseline all components to prepare for storage.
- 4) **Software configuration management update mode.** This mode enables software maintenance updates and configuration verification from local or remote locations individually and collectively for like components.

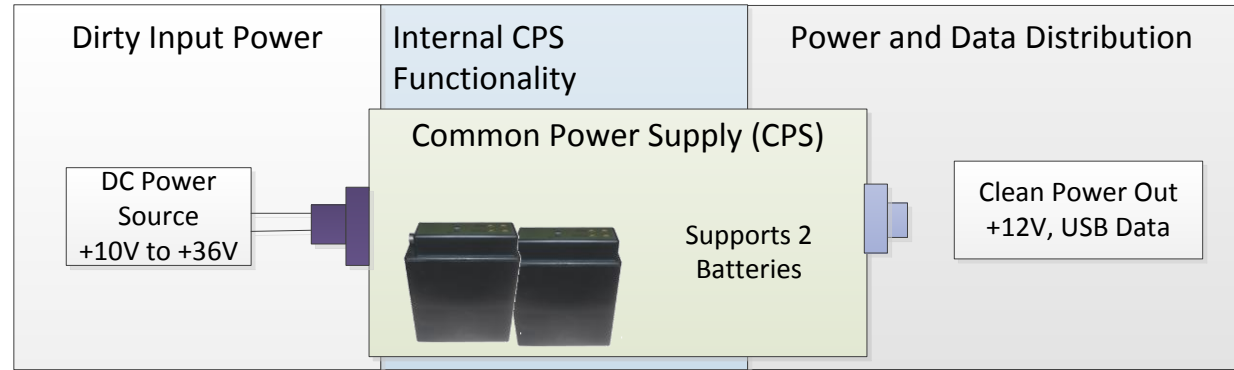




Common Power Supply (CPS)



Dirty Power Input & Protections



NOTE: CPS input connector, pin and wire gage and physical configuration determined by implementing contractor (CPS HCA)

- **Single Input Power Connector**
 - Mil Spec Input Connector with 2 pins
 - Positive
 - Negative / Ground
- **Input Power Range**
 - DC Power 10V - 36V
- **Maximum Current Draw**
 - Dynamic / Configuration enabled based on platform allowance
- **Protection – Spike and Polarity**
 - Transient voltage protection in accordance with MIL-STD1275
 - Reverse Polarity Protection
 - Over Voltage/Current Protection
 - DC input current monitoring to prevent excessive input current during charging
- **Input Power Sources / Family of Cables** (*various dirty sources....*)
 - Vehicle Dome Light
 - NATO slave plug
 - Battery direct and commercial trucks (cigarette lighter, cut in wires)
 - Solar Panel





CPS Batteries & Capability



CPS will host two BB-2590/U Batteries (293 Watt Hours version-baseline)

- PM Field OPS recommends 2590 due volume of batteries & chargers fielded
- CPS WG recommends 2590 due to higher power densities and dual 12 volt internal architecture that functions as two 12 volt batteries in a single case.

- **CPS shall have slots for 2 batteries and shall be capable of operation with either 1 or 2 batteries installed** (*low power usage, 1 battery installed – high demand, 2 batteries installed- adds less than 2 inches to length of CPS case*)
 - **CPS shall be capable of automatically determining the voltage of system it is working on.**
 - 12VDC vehicle will have normal operating voltages of 13-14VDC when the engine is running.
 - 24VDC vehicle will have normal operating voltages of 26-28VDC when the engine is running.
 - **The CPS shall determine if the vehicle charging system has been turned off:**
 - if 12 VDC vehicle power drops below 12.5VDC then the CPS should stop drawing from external power
 - if 24 VDC vehicle power drops below 25VDC then the CPS should stop drawing from external power
 - The CPS batteries shall operate independently
 - The CPS shall operate with our disruption if one of the two batteries isn't functional or out of charge
 - CPS shall operate off vehicle power if both batteries die and voltage input is above threshold
 - CPS shall operate if no batteries are installed provided the vehicle voltage is above threshold (power filter)
 - Replace batteries in less than 10 minutes (No special tools)
 - CPS shall secure the individual batteries from movement and damage
 - The CPS shall be capable of operating in a standalone mode (no input power connected) (bridge, building)
 - CPS shall support smart battery charging circuit level 2 minimum SMBus managed charging (smart charging)





CPS Clean Power Output



- **Connector (MilSpec 4 pin connector)**
 - 12 volts +(12.6v to 11.4v)
 - Max continuous current draw (10A) from CPS (w/ 20% spare capacity)
 - Voltage drop over longest line **.5V = (10.9V)** (CPS/Hub/End device)
 - CPS Primary power/USB single run cable “HUB” is unique keyed connector
 - Connector and Wire gauge TBD
 - DC Ground
 - USB 2.0 chipset
 - Data -
 - Data +

CPS output: Power and SMbus data on USB

Power Budget needs to be developed as part of CPS HCA (notional chart)

Minimum Simultaneous Current draw available at:

- Master Controller: Hub 1 (internal) and Hub 2 (external) interfaces (X Amps continuous and Peak) and direct Component Interfaces (4)
- Multi Hub 1 and Hub 2 1st hub in line
- 2nd hub in line

Power Budget per device (Amps) for Continuous Use				
Device type	Master Controller	Hub	Legacy Hub	Total Power Budget per port
VKI	1			1
PAN Relay	1			1
Radio	1			1
TBD/VFVP	1			1
Crew Interface Module		1		1
1553		1		1
TBD/CDM		1		1
TBD		1		1
Legacy Device Hub			2	2
(Total Amps)	4	4	2	10





CPS USB / LTEC Messaging



- **CPS LPAN/LTEC Messaging** (USB data line - No wireless messaging)
 - New LPAN message cluster needs to be develop to support CPS and Individual Battery Status: Cluster will address the messages and LTEC recipients (Installer/Crew Display/ExCon-Logistics (I,C,L))

Specific messages and services need to be developed to be derived and implemented in CPS HCA

- CPS Power Up BIT Message (I,C,L)
 - Operational status – Go/No Go
 - Charging – Go / No Go
 - End of useful Life message - Replace battery
 - Low charge/Level
- CPS Continuous BIT / Alarm Notification Error (C, L)
 - Battery below a certain level – (*Crew Display & Logistics*)
 - Over Temp Event
 - Mode switching (Internal, external)
 - Battery end of life (flag)
- Logistic Messages (to ExCon)
 - CPS and Individual Battery S/N
 - Cycle Status
 - End of Life
 - Over temp

Messaging Examples

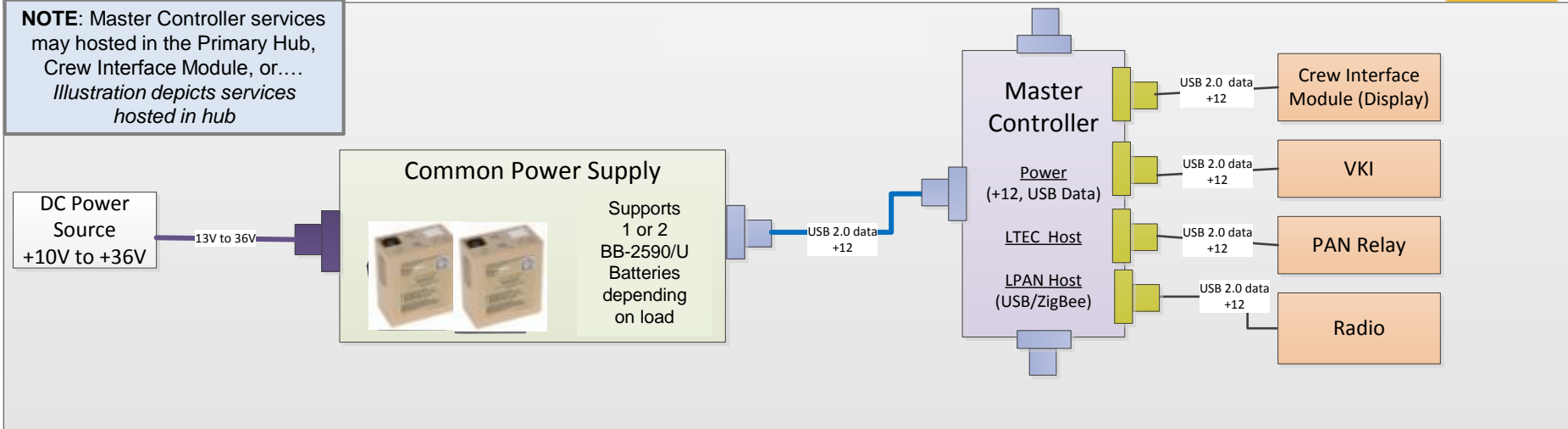




Base Configuration (no turret)



NOTE: Master Controller services may hosted in the Primary Hub, Crew Interface Module, or....
Illustration depicts services hosted in hub



• Purple Connector

- Main input power (+10V to +36V) Vehicle, NATO Slave, Dome light, Solar, AC to DC Adapter...
- Unique Connector – will not mate with any other CA device

• Blue Connector

- Provides primary clean power and USB network control (USB 2.0 Data Only, +12V)
- Supports connections between CPS/Hub, Hub/Hub
- Unique Connector- same connector on both ends – will not mate with any other CA device
- Larger Gauge cable wire to support power distribution

• Gold Connector

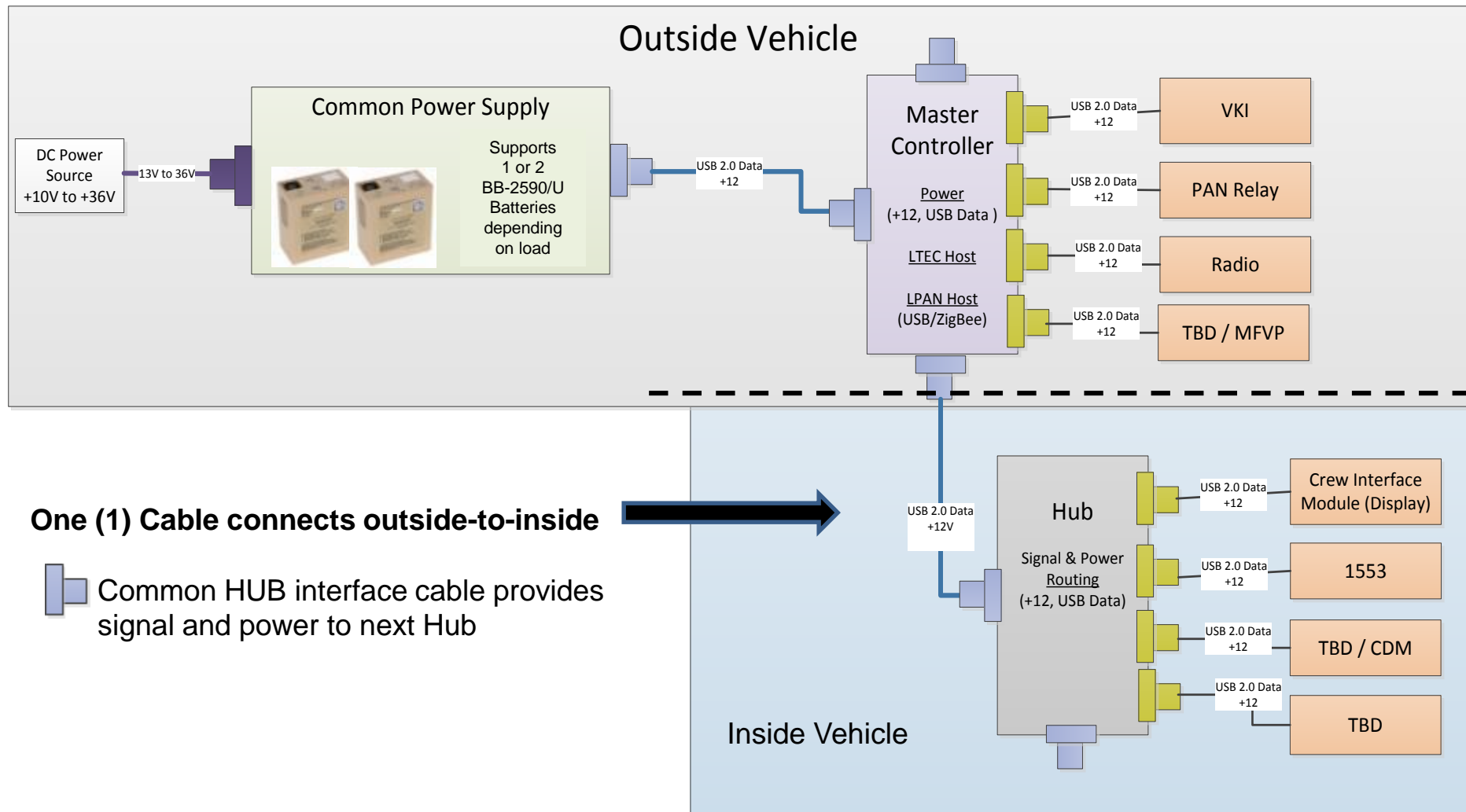
- Provides Clean Power and USB to Components (USB 2.0 Data only, +12V)
- Unique Connector from Hub to individual Component end device
- Smaller connector and smaller wire

Maximum Blue and Gold individual cable lengths are 15ft due to USB Data. Hubs will amplify signals



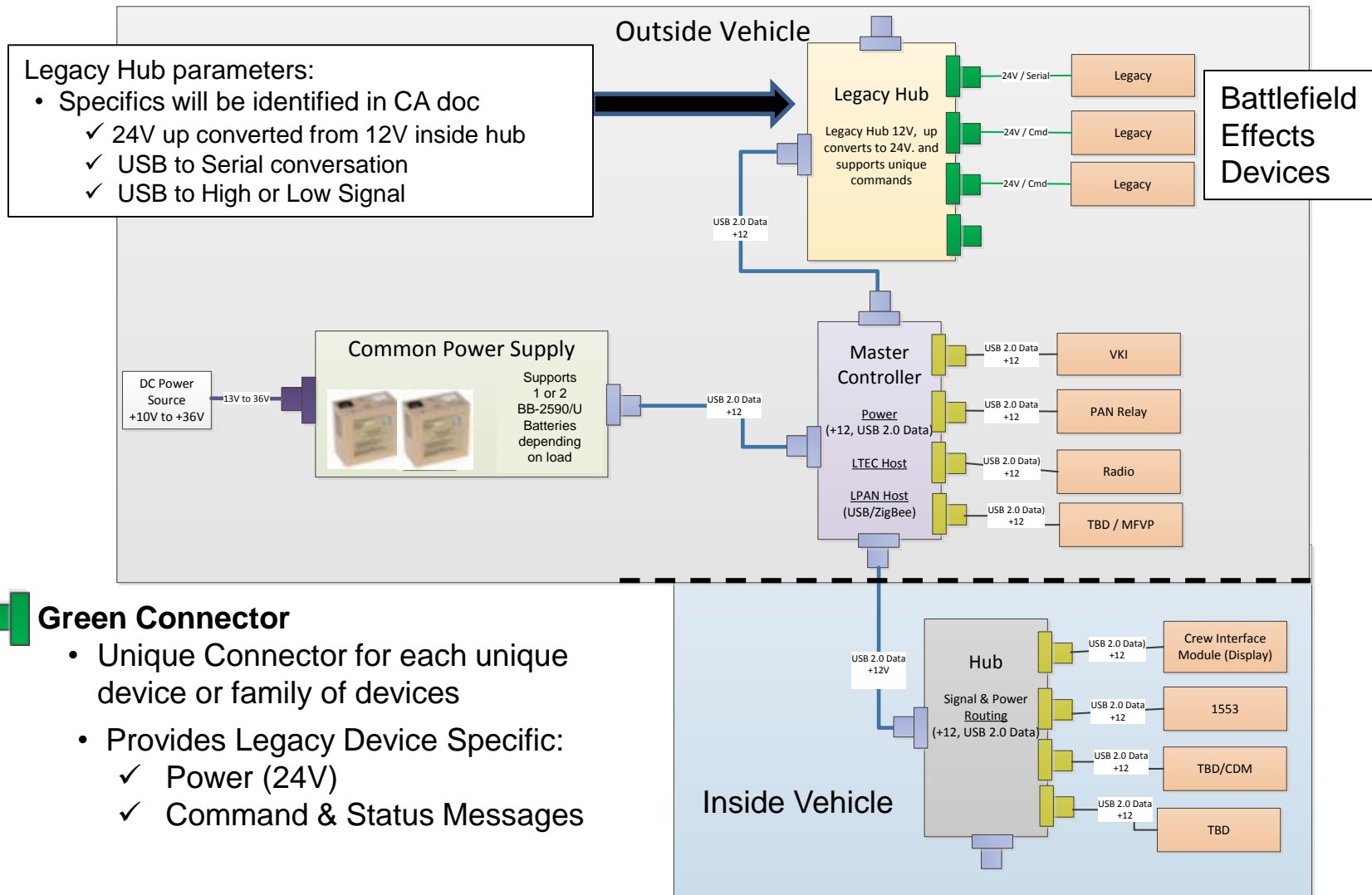


Turret Mounted Configuration





Unique Legacy Hub Configuration



Green Connector

- Unique Connector for each unique device or family of devices
- Provides Legacy Device Specific:
 - ✓ Power (24V)
 - ✓ Command & Status Messages

NOTE: Legacy hubs will eventually be eliminated. Future components will be direct USB interfaces IAW LT2 TESS CA





LPAN 24 Month Evolution (802.15.4)



LIVE TRAINING TRANSFORMATION (LT2)

LIVE PLAYER AREA NETWORK STANDARD

DOCUMENT NUMBER PRF-PT-00549

REVISION: D

03 MARCH 2015

Prepared Under Contract Number:
W900KK-10-D-001, ITEM NO 110001

Prepared for:
PEO STRI
12350 Research Parkway
Orlando, FL 32826-3276

Prepared By:
General Dynamics C4 Systems
12001 Research Parkway, Suite 500
Orlando, FL 32826-2970



LPAN Single network for LT2 TESS Components

- **Wireless:** 802.15.4 Zigbee
- **Wired:** USB 2.0, (480Mbps, 15' cables)

Note: AMITS & RCS
radios have same
interface requirements

The LPAN wireless network will utilize the ZigBee 802.15.4 chip set families that support the implemented standard. ZigBee was selected as the wireless protocol due to a host of reasons but primarily because the commercially ZigBee chipsets automatically manage the lower level networking, MAC, and physical layers. This reduces support and sustainment costs by allowing the user to manage only the upper application (LT2 TESS message) layer. The government does not intend to join the ZigBee federation and will only publish the message sets on the LT2 Portal.

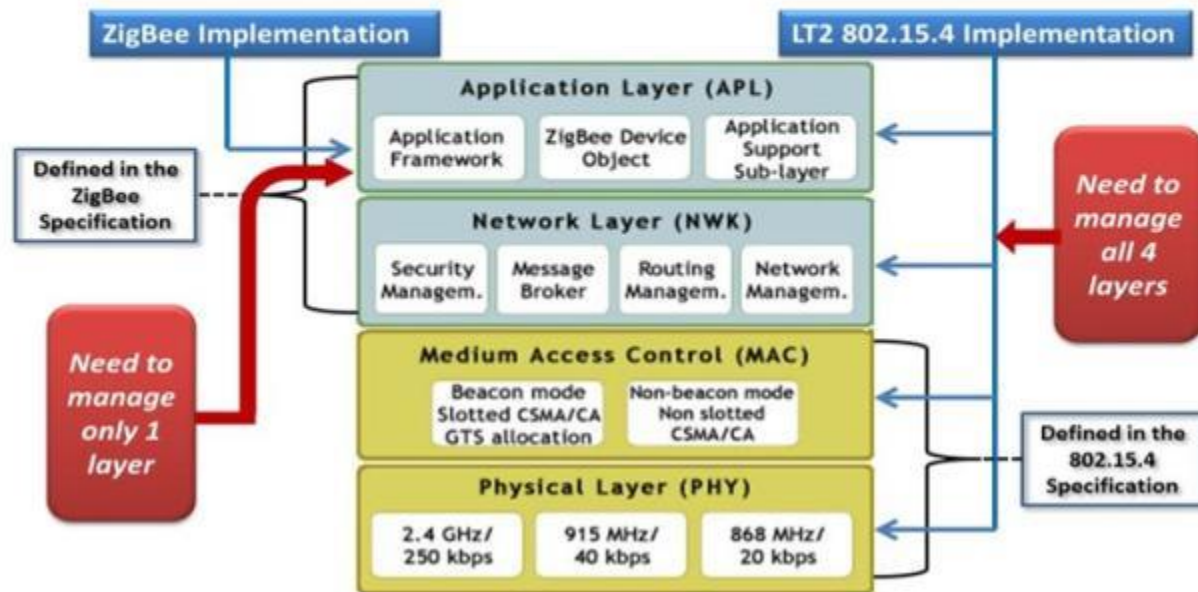


Figure 5 - PAN Stack Management





LPAN 24 Month Evolution (USB)



LIVE TRAINING TRANSFORMATION (LT2)

LIVE PLAYER AREA NETWORK STANDARD

DOCUMENT NUMBER PRF-PT-00549

REVISION: D

03 MARCH 2015

Prepared Under Contract Number:
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Orlando, FL 32826-2970



LPAN Single network for LT2 TESS Components

- **Wireless:** 802.15.4 Zigbee
- **Wired:** USB 2.0, (480Mbps, 15' cables)

Note: AMITS & RCS
radios have same
interface requirements

Reasons for USB 2.0

- USB 2.0 requires **less connector pins** (4 vs 9)
- Provides **longer cable distances** (15ft vs 9ft)
- **480 Mbps** supports communication requirements
- +12V would be available to augment USB (500mA)

Comparison chart

	USB 2.0	USB 3.0
Released	Apr-00	Nov-08
Speed	High Speed or HS, 480 Mbps (Megabits per second)	10 times faster than USB 2.0. Super Speed or SS, 4.8 Gbps (Giga bits per second)
Signaling Method	Polling mechanism i.e can either send or receive data (Half duplex)	Asynchronous mechanism i.e. can send and receive data simultaneously (Full duplex)
Price	For a similar product, the USB 2.0 version is generally less expensive than it's USB 3.0 version.	For a similar product, the USB 3.0 version is generally more expensive than it's USB 2.0 version.
Power Usage	Up to 500 mA	Up to 900 mA. Allows better power efficiency with less power for idle states. Can power more devices from one hub.
Number of wires within the cable	4	9
Standard-A Connectors	Grey in color	Blue in color
Standard-B Connectors	Smaller in size	Extra space for more wires
Max Cable length	5 meters	3 meters

Maximum cable length is 15ft due to USB Data. Hubs will amplify signals





LTEC 24 Month Evolution



Live Training Engagement Composition (LTEC)

Interface Control Document (ICD)

Document Number PRF-PT-00608

Version 1.2

Prepared for:

Project Manager Training Devices (PM TRADE)
12350 Research Parkway
Orlando, FL 32826-3276

Date: 09 March 2015

Developed under:

Consolidated Product Line Management (CPM)
Delivery Order (DO) #13
Contract No.: W900KK-10-D-0001/0013

LTEC Services have expanded to incorporate many of the new LT2 TESS LPAN messages (7 version updates in 24 months)

Other services need to be developed

NOTE: Other ongoing LTEC concurrent development efforts require process adherence to ensure an integrated LT2 Product Line

Update new postings: L-PAN Standard PRF-PT-00549, LT2 Interoperability Enumerations PRF-PT-00617 LT2 L-PAN Component Message Set Description (CMSD) PRF-PT-00635, well as several LTEC documents (SVD, ICD, Developer's Guide, component agreements)





LT2 TESS LPAN/LTEC Demonstration



- **Demonstrate LPAN/LTEC running on legacy TVS VKC HW (Master Controller) and communicating with:**
- **LPAN (ZigBee – Wireless) Compliant Communications with:**
 - ✓ Detector, User Interface Module, and an RF Repeater - **CUBIC**
 - ✓ Medium Range Laser Transmitter (MRLT) - **Zeltech**
 - ✓ IWS SAT – **GDC4S**
 - ✓ MILES XXI Components to Master Controller - **Lockheed Martin**
- **LPAN (Wired) Message Compliant Fire Control Communications using MILES XXI Components with:**
 - ✓ Fire Control Interface - **Lockheed Martin**
 - ✓ Main gun laser Transmitter (MGLT) - **Lockheed Martin**
 - ✓ Vehicle Display Assembly (VDA / Loader Interface) - **Lockheed Martin**





LPAN/LTEC WG Demonstration



Lockheed Martin MILES XXI Components

MILES XXI components modified to support wired LPAN message format

FCI Trigger Box

Crew Display (LM)

VDA

Fire Control Interface (LM)

Main Gun Laser TX (MGLT) (LM)

Supports Wired LPAN Compliant Laser TX Msgs

Power

RS-485 to Wireless LPAN Bridge

A SBC with USB to RS-485 dongle and USB to ZigBee dongle (CC2531)
(SW developed on CPM)

Validates HW Components from various programs & vendors interacting

TVS running LTEC/LPAN (Master Controller) with VKI & CCM

IS Radio

RS-232

SAT

MRLT (Zeltech)

Cubic

IWS SAT

Detector

User Interface Display (CCM)

LPAN (ZigBee)

LPAN (ZigBee)

RS-485 Bus

RS-485 Bus





LT2 TESS Component Development Kit Overview

5 Kits available for industry check-out



- **Kit contains the following parts:**

- 1 VKC – Master controller running LTEC SW
- 8 VDUs – MILES Detectors (uses AA batteries)
- 1 CCM – Crew Control Module (or CIM)
- 1 SMRFI – ZigBee radio repeater
- 1 VKM – Kill Indicator (Strobe)
- Power Cables for VKC & CCM charging

Note: SAT not included as part of Kit, but has SAT LTEC/LPAN Services Installed)



- **Operator / User Manual will be available on the LT2 Portal**

- **Kits can be leveraged by:**

- Either interfacing your 3rd Party components (like detectors or SATs) with VKC running LTEC 1.2 (can not update LTEC SW at this time)
- Or by interfacing your 3rd Party master controller (running your version of LTEC 1.2 SW) to TVS components in the kit (like the CCM and VDUs)





Things you Can Do with a Component Development Kit



- Associate / Disassociate TVS or Vendor specific Components
- Control Mode On / Off
- Change Vehicle Types
- Change Vehicle PID
- Shoot Detectors with MILES Codes
- VKC / VMC perform LEAR assessments
- Reset / Resurrect
- View System Status
- Initiate System BIT
- View Event Log

Integrate and verify your LT2 TESS Components





Things you Can NOT Do with a Component Development Kit



- Do not open up any component
- Do not physically modify any component
- It is not recommended to modify / update LTEC
 - ✓ *If LTEC / LPAN is modified / updated on any component and it breaks the system, the system must be returned to the government for repair or re-baselining (cuts into your 2 week check out time)*
- LTEC can be modified / updated without opening up the VKC, however a programming cable is needed for this.
(GD has cable)





LTEC Developers Kit Check Out - April 2nd



Show of hands, Who wants to check out a Developers Kit this week????

- Kits will be checked out on a lottery basis on 2 April if more vendors want kits than available.
- Kit is available for two weeks at a time based on demand
 - Out of state contractors are provide and additional 2 days each way for shipping time.
- The kit will be distributed (and returned) to Bldg 4, Room 105 at Noon on Friday April 2
 - Visitors Center by Science Gate
- Transportation (pick-up and return) are the responsibility of the borrowing organization
 - Kit case is 3' x 3' x 1.5' and weighs approximately 100 lbs..
- Coordinate inventory, check out and return with Jose Rodriguez,
jose.s.rodriquez20.civ@mail.mil at pH 407-384-3964.
- Future Kit Check out requests should be sent to richard.j.lawson.civ@mail.mil, Subject; Loan of LTEC TVS Kit,





Common Message WG Accomplishments



- **End-State Vision:** IS-TESS ICD that eliminates the need for instrumentation radio software updates due to the introduction of new TESS and training capabilities (OEM \$).
- **Published IS-TESS Revision D (PRF-PT-00552D) in July 2013.**
 - Included significant updates to the Variable Payload structure and messages initially implemented
 - Included new USB interface and updated standard to better define physical connections.
 - Added significant number of new vehicle initialization types to support TVS program.
- **Developed IS-TESS Revision E over the last 18 months.**
 - Live Training Transformation (LT2) Message Set Description (Rev - 0) PRF-PT-00635 Standard addresses Message Structure NOT DATA elements and segregates data into common enumerations document
 - LT2 Interoperability Enumerations PRF-PT-00617 identifies specific data elements which supports both the LPAN standard and the IS-TESS standard. **(Published)**
 - Cleaned up the standard significantly and removed unneeded carryover information from original merging of legacy ICD/standards. Lots of fixes, corrections. Also, added ability for IS to set the PID on the TESS.
 - Analyzed existing TESS and IS programs to determine what messages were actually being used and needed to be supported - resulting in deletion of messages not currently used by CTIA and LT2 EXCON.
 - Added additional Variable Data Message enumerations to cover existing messages

✓ **AMITS**
✓ **RCS (rev c)**

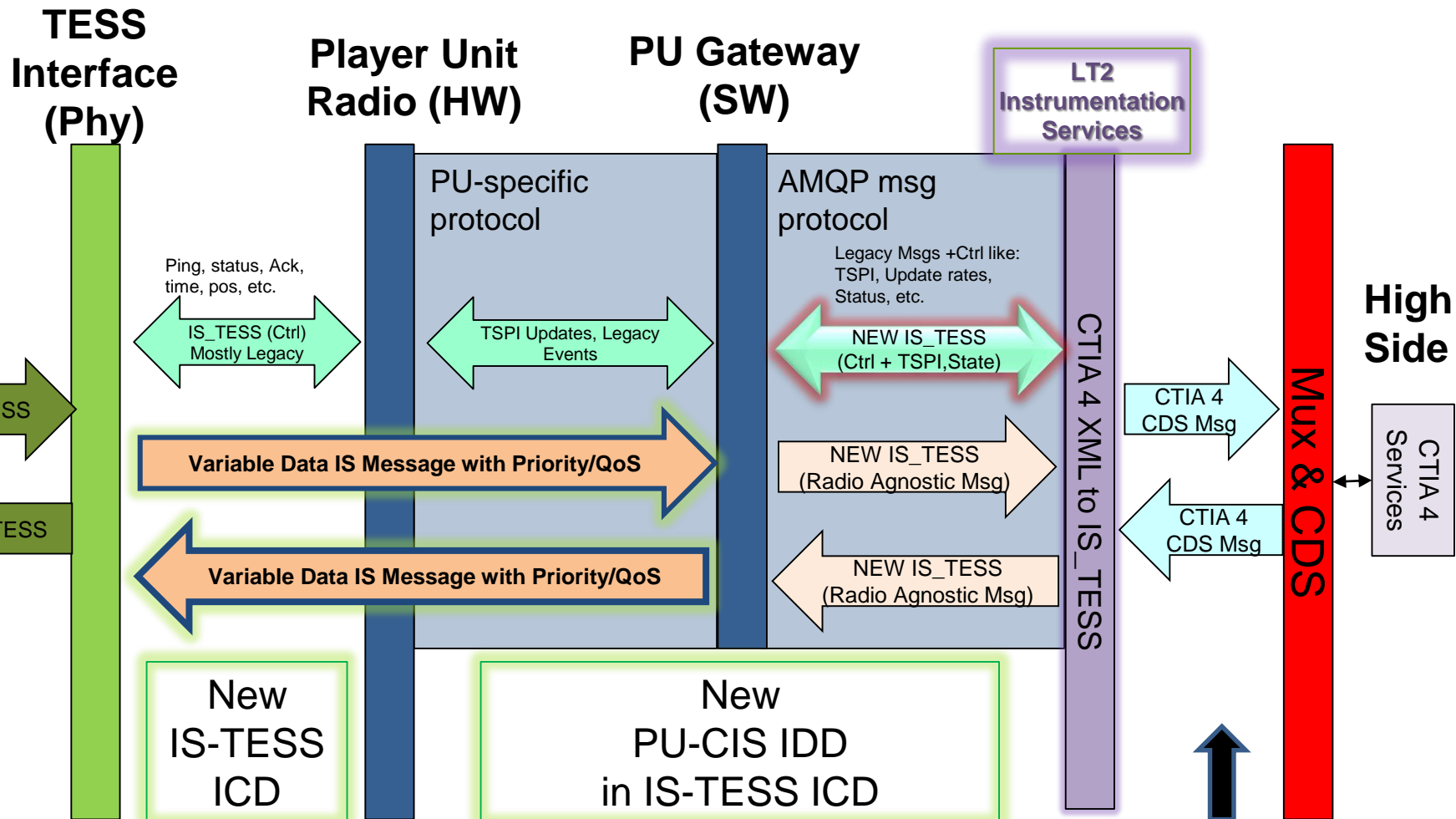
✓ **Published 27 MAR**
- VTESS rqmt.

Lots of good dialog with CTC-IS RCS & AMITS contractors regarding future implementation of a common LT2 interface.





TESS-CTIA Interface Concept (Future)



Radio becomes a Commodity like other Components

Native Data Structure
TESS, GPS, Video, Bus, Log,...





LT2 TESS Standards WG Accomplishments Summary



- **Industry & Gov't WG achieved initial objectives:**
 - Created Functional Component Architecture (CA) supporting future PM TRADE LTS/DT/CTIS acquisitions and technology insertion
 - Established initial set of key Components and interfaces for LT2 TESS
 - Developed initial set LT2 TESS HCA documents
 - Established Common Power Supply HCA for use across PM TRADE
 - Matured LPAN wire and wireless message stack
 - Matured LTEC SW services
 - Demonstrated CA using LPAN, LTEC on multiple companies products
 - Provided industry an LTEC/LPAN CA development/verification tool
 - Established the foundation documentation for the VTESS acquisition





LT2 TESS Standards WG Summary



- Appreciate all of our Industry partners support and commitment over the the last 24 months.
- Products will be the foundation for VTESS Architecture
- Working Groups will resume after the VTESS contract award likely 4 months after award and be held on a bi-monthly or quarterly basis (*specifics TBD*).

Thank You!

***Entering a new era of LT2 TESS family of
Components, Standards, & Services***





LTEC/LPAN Services Agenda



Day 1: 1300-1600

- Overview of LTEC and 1.2 Release
- Results of TVS ECP Testing (mid-Feb)
- Features planned for 1.2.1 Patch Release (late June –or NLT Draft RFP)
- Overview of Support Tools
- Demonstration of TVS ECP HW integrated with MILES XXI Fire Control HW
- Industry Component Development Kit Overview
 - Check-out Procedures
 - Sign-out & Lottery (if required)





LT2 LTEC Developers Course



April 1 & 2: 0830 – 1600

- **Prerequisites to bring to the course**

- ✓ Windows 7 laptop (with DVD/CDROM drive if possible to load training material)
- ✓ Visual Studio (or Express) 2013 (or gcc 4.4 compiler –like Mingw or Cygwin)
- ✓ CMake 2.8.12.2 or greater installed and built
- ✓ LTEC 1.2 downloaded, installed and built (if possible) per instructions in the latest LTEC Developer's Guide
- ✓ Latest version of TortoiseSVN that supports at least v1.8 of SVN to install class labs (distributed as patch files)
- ✓ Working knowledge of C/C++ programming

- **Class Size:** 2 per company maximum (additional seat requests will be allowed on a space available basis by random selection.

(Mandatory RSVP by March 20th noon EST) richard.j.lawson.civ@mail.mil





Dial-in and web connect information



GDC4S call in

Connect Web Session: <https://connect.gdc4s.com/garyhall>

Audio: 1-866-441-9660 Meeting ID: 7017





LTEC Agenda



1. Introduction

Day 1: 1300-1600

2. Last Meeting Recap

3. Today's Objectives:

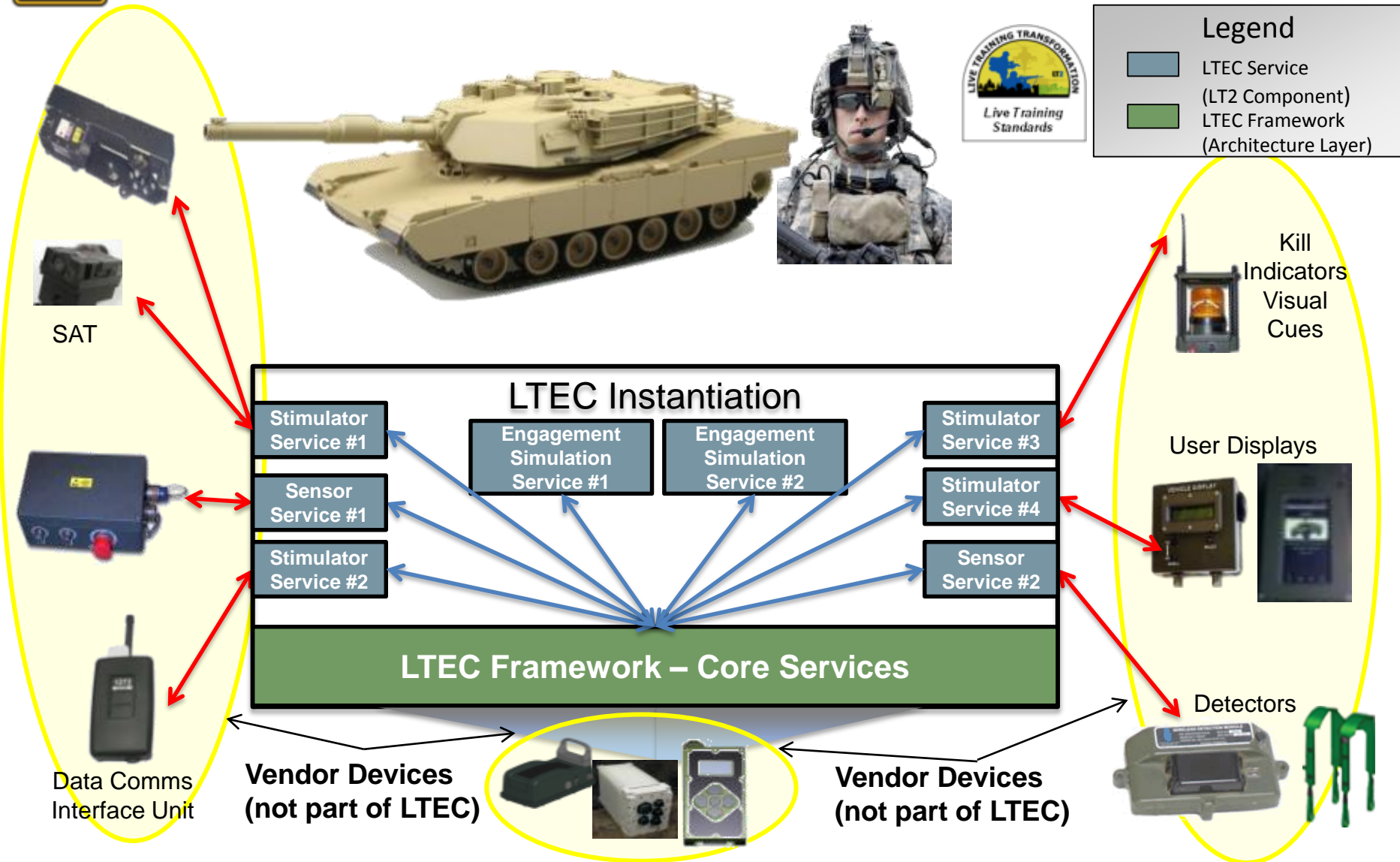
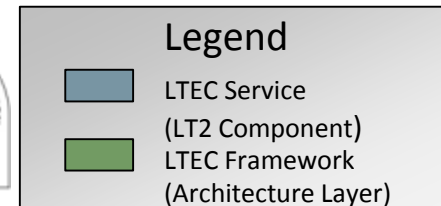
- a) Overview of LTEC & 1.2 Release
- b) Results of TVS ECP Testing (mid-Feb)
- c) Features planned for 1.2.1 Patch Release (late June)
- d) Overview of Support Tools
- e) Demonstration of TVS ECP HW integrated with MILES XXI Fire Control HW
- f) TVS Kit Overview and Check-out Procedures and Sign-out/Lottery

4. Questions / Actions / Wrap up





LTEC Overview

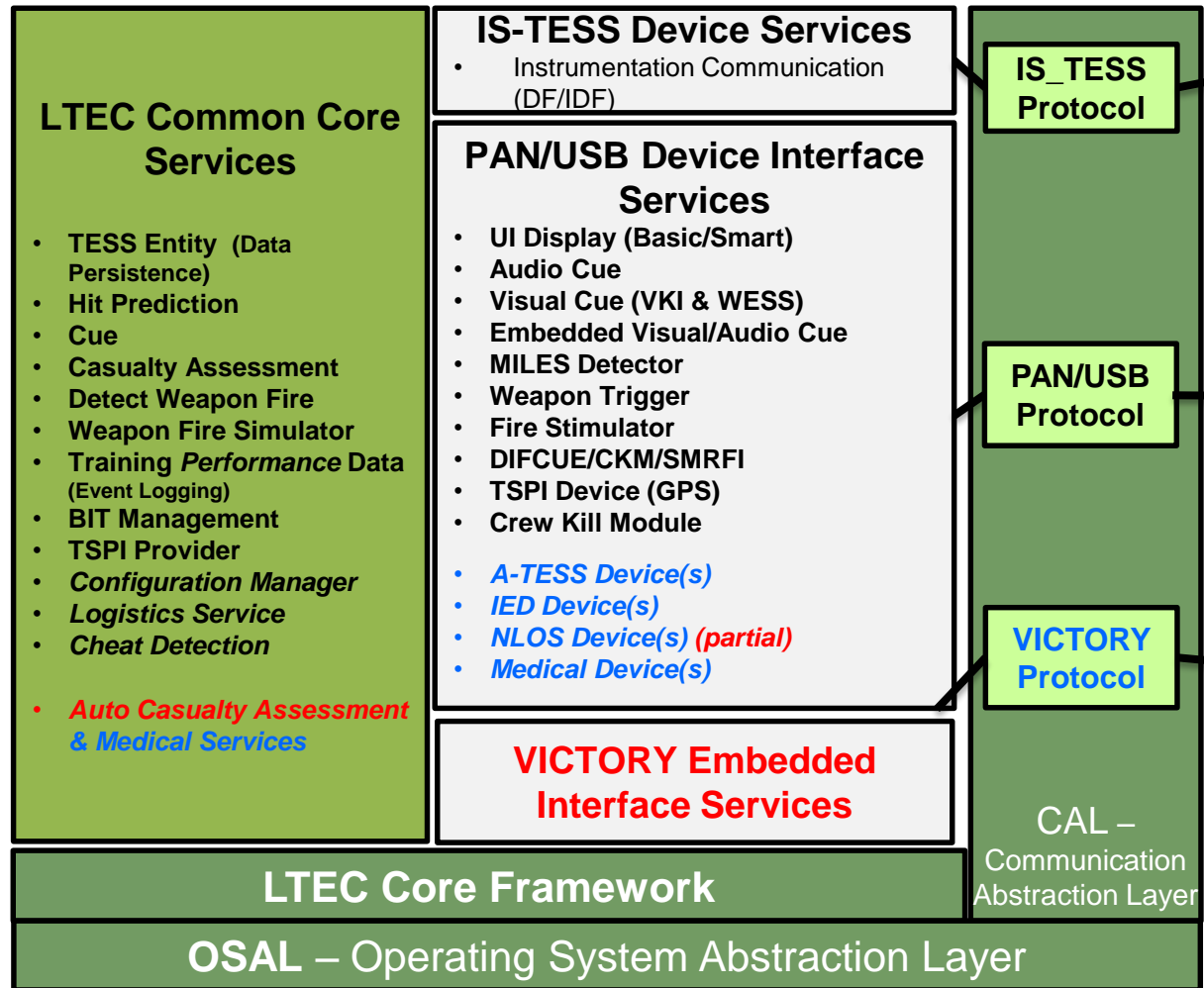




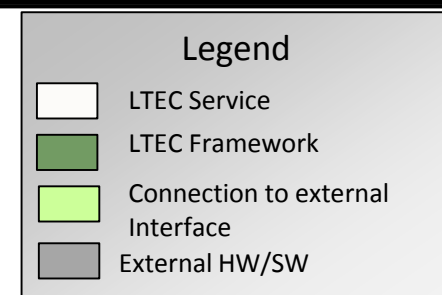
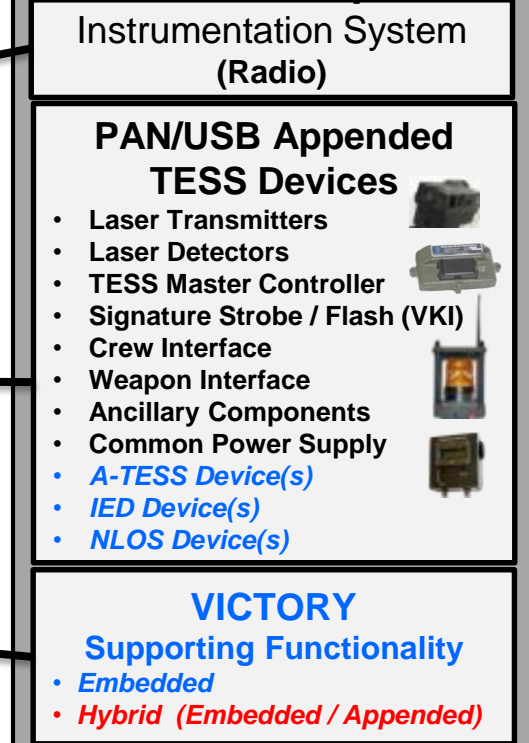
LTEC Architecture



LTEC Software Components



Industry Provided Products / Components

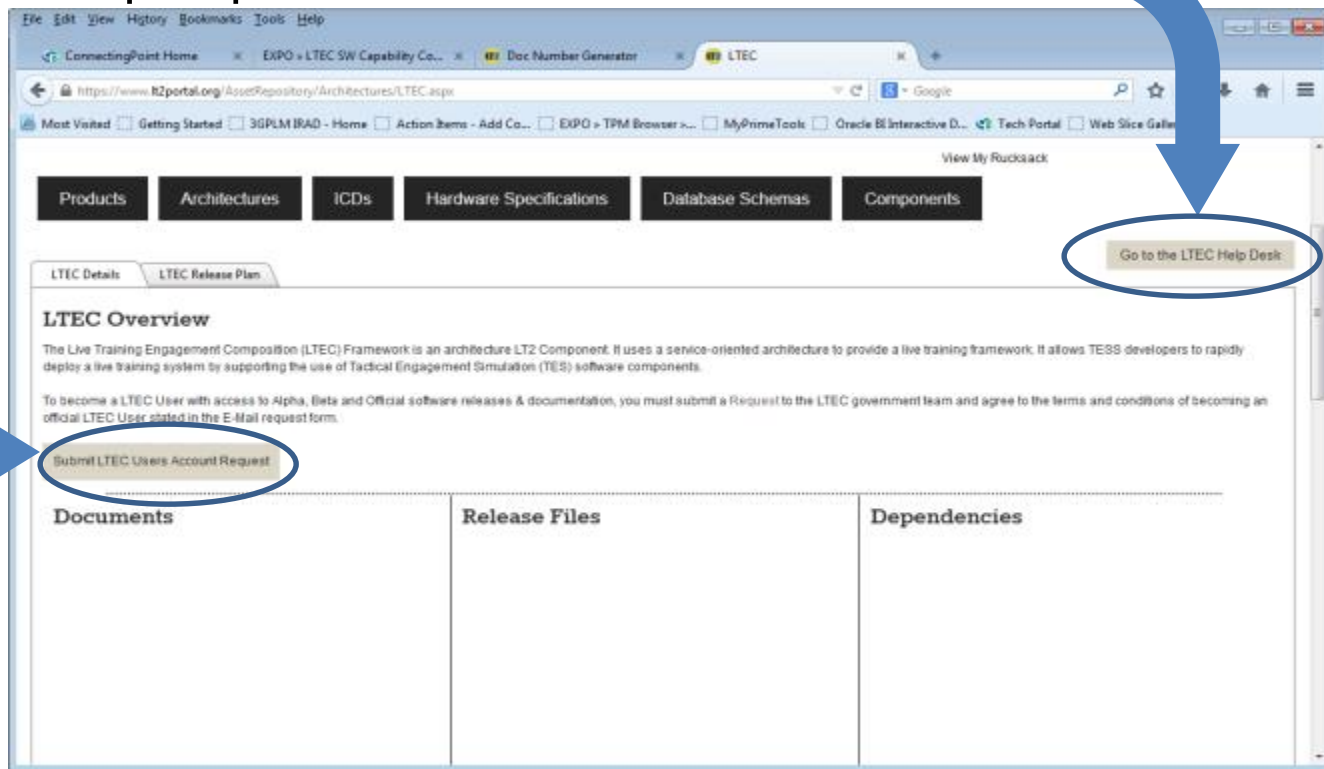




Accessing LTEC 1.2 Release



- LTEC Portal Page: <https://www.lt2portal.org/lt2ec>
 - Access to LTEC documents and tools
 - Location to request membership to LTEC Users Group for SW access
 - Request help or post issues

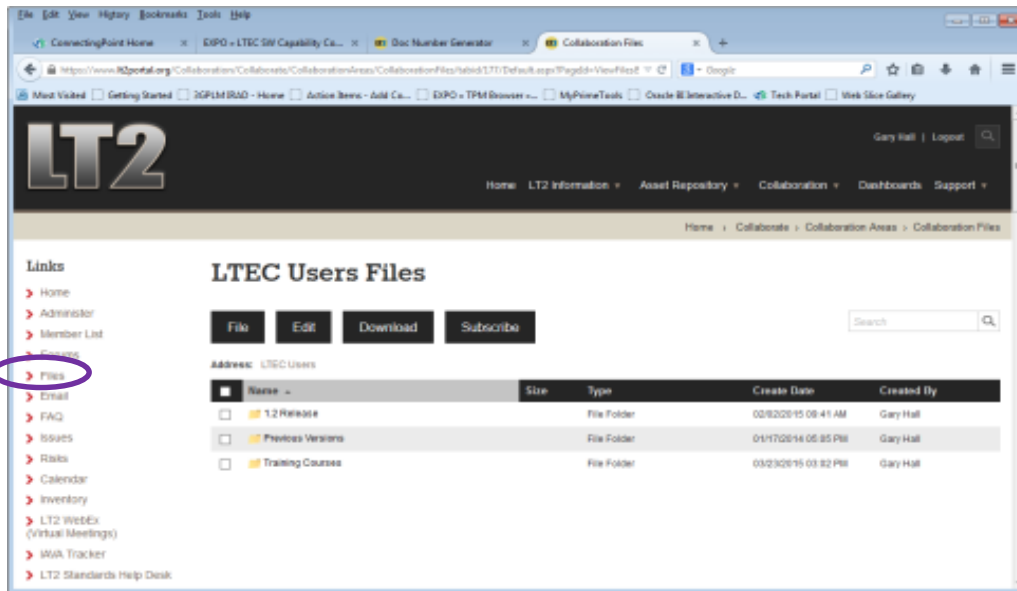




Accessing LTEC 1.2 Release



- LTEC Users Collaboration Group
 - Requires approved membership (see request on LTEC page)
 - Requires Software Access LT2 Portal Account Type
 - Location of SW & Utils for LTEC 1.2 Release ([click on Files Link -left](#))
 - Location of 1.2 Release Software
 - Note: Location of Component Agreements & Developer Guide & SVD will be at: <https://www.lt2portal.org/ltec>





Related Standards Documentation



- Updated **LTEC 1.2 ICD** (on LT2 Portal in Standards)
 - Defines external interfaces and LPAN Radio module interface
- Updated **Live PAN Standard** (PRF-PT-00549) **Rev D**
- New **Message Set Description Doc** (PRF-PT-00635)
 - Contains Live PAN Clusters and Message Definitions
- New **Interoperability Enumerations Document** (PRF-PT-00617)
 - Supports L-PAN and IS-TESS Standards
- Updated **IS-TESS Interface Standard** (PRF-PT-00552) **Rev E**



Location on Portal: <https://www.lt2portal.org/tabid/82/ABPageId/ABlcdTree/Default.aspx>





LTEC 1.2 Framework & Core Services



- LTEC_Framework
 - Core Set of LTEC libraries (contains Data Model, Message Brokers, ...)
- TES Entity Service
 - Stores Entity State and persists key entity data (vehicle type, PID, etc) and **Logistics data for Master Controller**
- Hit Prediction & Casualty Assessment Services
 - **Updated support for GMR**
 - **Added additional Admin Kill Support (Mobility, Firepower, Comms, Hit)**
- Cue Service
 - Support for Visual and Audio Device cues (Strobe, audio)
 - **Limits cues if external power not present (default 10 mins)**
- Training Data Performance Service
 - Subscribes to key system and engagement events and logs to persistent log file
 - Supports **clearing events**, requesting stored events (**by event category**)

*Note: **Purple Text** indicates new or recently added capabilities. See Component Agreements for details.





LTEC 1.2 Core & Device Services



- Component Status Service (formally BIT Manager)
 - Tracks & Manages components within LTEC
 - Support for periodic BIT/OPS data request as well as manual Execute BIT
 - Handles routed commands from Smart Display (CIM) like manual Disassociate, SAT Dry Fire, etc.
 - Manages number of required devices by device type (detectors, SATs, etc)
- Cheat Detection Service (New)
 - Manages status of various Cheat Kill events (motion after mobility kill, lost devices, ...)
- PAN MILES Detector
 - Supports MILES Detector DF and Detector Missile PAN Messages
- PAN Fire Stimulator
 - Communicates with PAN based laser TX systems (SAT, MGLT)
 - Support to Set PID, MILES Code to transmit, Dry Fire, Red Laser Enable/Disable
- GPIO Visual Cue
 - Supports visual strobes connected directly to the MC via GPIO pins

*Note: Purple Text indicates new or recently added capabilities. See Component Agreements for details.





LTEC 1.2 Device Services



- PAN Audio Cue Service
 - Provides interface to PAN based remote audio cue devices
- Embedded Audio Cue Service
 - Supports audio cues for embedded audio HW on the MC for Intercom injection
 - Support for continuous tone, ack of kill tone, multiple audio event (Near Miss – Front Left)
- Instrumentation Communication Service
 - Provides interface with IS Radios via IS-TESS Standard
 - Supports reporting events as well as receiving event commands (kills, set veh type, etc)
- TSPI Device and Provider Services
 - Provides interface with GPS receivers and provides UTC time, entity location, speed, if entity is moving.
- PAN Weapon Trigger Service
 - Provides interface with PAN based weapon trigger devices (e.g. Fire control Interface)

*Note: Purple Text indicates new or recently added capabilities. See Component Agreements for details.





LTEC 1.2 Device Services



- Smart Display Service (CIM)
 - Communicates with smart UI devices (like CIMs or TVS' CCM)
 - Supports event requests from CIMs (via TDPS)
 - Supports Component List Requests (to get current list of components in system)
 - Supports BIT and OPS status requests as well as **Execute BIT**
 - **Supports Admin requests (Set PID, Vehicle Type)**
- Simple User Display Service (Alt Display – Loader)
 - Supports simple text display and key press
 - **Now supports Armor vehicle loader functions (weapon select, reload, etc)**
- PAN Fire Stimulator
 - Communicates with PAN based laser TX systems (SAT, MGLT)
 - Support to Set PID, MILES Code to transmit on fire, **Dry Fire, Red Laser Enable/Disable**

*Note: **Purple Text** indicates new or recently added capabilities. See Component Agreements for details.





LTEC 1.2 Device Services



- Weapon Fire Simulator Service
 - Controls the firing of simulated weapons (main gun, coax, etc) based on entity health and available ammo.
- GPIO Status Indicator
 - Controls status indicators (LEDs) for external battery and BIT status
- DIFCUE Service (New)
 - Control the triggering of an external Direct/Indirect Fire Cue Device via GPIO pin
- Crew Kill Module Service (New)
 - Communicates with CKM devices via LPAN to send MILES kill codes to mounted soldiers when vehicle is killed
- Other (Dismount support)
 - Fly-out, Mortar Service

*Note: Purple Text indicates new or recently added capabilities. See Component Agreements for details.





LPAN Component Msgs (Detector)



	Minimum -Basic	LTEC Compliant	Full Compliance	
Message Name (LPAN RF Messages)	Source ICD	Sender	Receiver	Comment
NA-Association-Request (0x0001)	PRF-PT-00549 & PRF-PT-00635	MILES Receiver (Detector)	LTEC	ClientClass: MILES Receiver, Device Type: MILES Detector (left, right, front,rear, or top), Supported Clusters: NA, CC, MD, BIT, OPS, NAM
NA-Association-Response (0x0002)	PRF-PT-00549 & PRF-PT-00635	LTEC	MILES Receiver (Detector)	
NA-Disassociation-Request (0x0003)	PRF-PT-00549 & PRF-PT-00635	LTEC	MILES Receiver (Detector)	Disassociates with server and Sends NA-Association-Status-Report as reponse with new Disassociation State (then leave ZigBee network and coordinator)
NA-Association-Status-Request (0x0005)	PRF-PT-00549 & PRF-PT-00635	LTEC	MILES Receiver (Detector)	
NA-Association-Status-Report (0x0004)	PRF-PT-00549 & PRF-PT-00635	MILES Receiver (Detector)	LTEC	Contains network status of device and also sent as response to disassociation request.
NA-Association-Verification-Request (0x0097)	PRF-PT-00549 & PRF-PT-00635	MILES Receiver (Detector)	LTEC	For devices to verify connection with LTEC server
MD-Laser-Detection-Report (0x0047)	PRF-PT-00549 & PRF-PT-00635	MILES Receiver (Detector)	LTEC	Main MILES Detection event
MD-Detector-Configuration-Request (0x0043)	PRF-PT-00549 & PRF-PT-00635	LTEC	MILES Receiver (Detector)	Used by LTEC to request the configuration of a detector which includes location and whether it is a required detector
MD-Detector-Configuration-Report (0x0044)	PRF-PT-00549 & PRF-PT-00635	MILES Receiver (Detector)	LTEC	Used by a detector to report its configuration which includes location and whether it is a required detector after requested or updated.
MD-Laser-Guided-Missile-Detection-Report (0x0048)	PRF-PT-00549 & PRF-PT-00635	MILES Receiver (Detector)	LTEC	MILES Detection event for guided missiles (has more fields&detail)
BIT-Status-Report (0x0012)	PRF-PT-00549 & PRF-PT-00635	MILES Receiver (Detector)	LTEC	Includes battery level
BIT-Status-Request (0x0013)	PRF-PT-00549 & PRF-PT-00635	LTEC	MILES Receiver (Detector)	
OPS-Operational-Status-Report (0x000B)	PRF-PT-00549 & PRF-PT-00635	MILES Receiver (Detector)	LTEC	Logisitics type info like SW ver, serial #, runtime, # of power cycles, etc.
OPS-Operational-Status-Request (0x000C)	PRF-PT-00549 & PRF-PT-00635	LTEC	MILES Receiver (Detector)	
MD-Detector-Configuration-Update (0x0045)	PRF-PT-00549 & PRF-PT-00635	IR Programming device or LTEC Server	MILES Receiver (Detector)	Sent by LTEC (or IR device) to change detector location (left, right, rear,front,top). May also use CC command below.
OPS-Operational-Status-Clear-Cmd (0x0099)	PRF-PT-00549 & PRF-PT-00635	LTEC or IR Device	MILES Receiver (Detector)	Could be sent over RF or IR (out-of-band) to clear or reset current values being tracked.

Message Name (IR Messages) - Sent Out of Band	Source ICD	Sender	Receiver	Comment
NAM-Manual-Association-WPAN-Cmd (0x0098)	PRF-PT-00549 & PRF-PT-00635	IR Programming device	MILES Receiver (Detector)	Message to manually associate with LPAN parameters such as PAN chan, PAN ID
NAM-Manual-Association-Cmd (0x008A)	PRF-PT-00549 & PRF-PT-00635	IR Programming device	MILES Receiver (Detector)	Message to manually associate but no LPAN parameters are provided so previous parameters are sent
CC-Client-Configuration-Cmd (0x0006)	PRF-PT-00549 & PRF-PT-00635	IR Programming device	MILES Receiver (Detector)	To change the detector device type (i.e.: location: left, right, front,rear, top). May use config update above
OPS-Operational-Status-Clear-Cmd (0x0099)	PRF-PT-00549 & PRF-PT-00635	IR Programming device	MILES Receiver (Detector)	Could be sent over RF or IR (out-of-band) to clear or reset current values being tracked.





LPAN Component Msgs (MRLT)



	Minimum Set	LTEC Compliant	Future	
Message Name (LPAN RF Messages)	Source ICD	Sender	Receiver	Comment
NA-Association-Request (0x0001)	PRF-PT-00549 & PRF-PT-00635	MILES Transmitter (SAT)	LTEC	ClientClass: MILES Receiver, Device Type: MILES Detector (left, right, front,rear, or top), Supported Clusters: NA, CC, MD, BIT, OPS, NAM
NA-Association-Response (0x0002)	PRF-PT-00549 & PRF-PT-00635	LTEC	MILES Transmitter (SAT)	
NA-Disassociation-Request (0x0003)	PRF-PT-00549 & PRF-PT-00635	LTEC	MILES Transmitter (SAT)	Disassociates with server and Sends NA-Association-Status-Report as reponse with new Disassociation State (then leave ZigBee network and coordinator)
NA-Association-Status-Request (0x0005)	PRF-PT-00549 & PRF-PT-00635	LTEC	MILES Transmitter (SAT)	
NA-Association-Status-Report (0x0004)	PRF-PT-00549 & PRF-PT-00635	MILES Transmitter (SAT)	LTEC	Contains network status of device and also sent as response to disassociation request.
NA-Association-Verification-Request (0x0097)	PRF-PT-00549 & PRF-PT-00635	MILES Transmitter (SAT)	LTEC	For devices to verify connection with LTEC server
MTXC-MILES-Laser-TX-Enable-Disable-Cmd (0x0049)	PRF-PT-00549 & PRF-PT-00635	LTEC	MILES Transmitter (SAT)	To disable or enable SAT
MDF-MILES-Laser-DF-Report (0x0050)	PRF-PT-00549 & PRF-PT-00635	MILES Transmitter (SAT)	LTEC	Sent by SAT when Rounds are fired (based on configuration of # of round/time in a burst)
MTXC-MILES-Laser-TX-Set-PID-Cmd (0x004B)	PRF-PT-00549 & PRF-PT-00635	LTEC	MILES Transmitter (SAT)	
MTXC-MILES-Laser-TX-Dry-Fire-Cmd (0x004A)	PRF-PT-00549 & PRF-PT-00635	LTEC	MILES Transmitter (SAT)	Used to dry fire the SAT from LTEC or crew UI control.
BIT-Status-Report (0x0012)	PRF-PT-00549 & PRF-PT-00635	MILES Transmitter (SAT)	LTEC	Includes battery level
BIT-Status-Request (0x0013)	PRF-PT-00549 & PRF-PT-00635	LTEC	MILES Transmitter (SAT)	
OPS-Operational-Status-Report (0x000B)	PRF-PT-00549 & PRF-PT-00635	MILES Transmitter (SAT)	LTEC	
OPS-Operational-Status-Request (0x000C)	PRF-PT-00549 & PRF-PT-00635	LTEC	MILES Transmitter (SAT)	Logisitics type info like SW ver, serial #, runtime, # of power cycles, etc.
OPS-Operational-Status-Clear-Cmd (0x0099)	PRF-PT-00549 & PRF-PT-00635	LTEC or IR Device	MILES Transmitter (SAT)	Could be sent over RF or IR (out-of-band) to clear or reset current values being tracked.
MM-TX Config Messages for Missiles	PRF-PT-00549 & PRF-PT-00635	LTEC	MILES Transmitter	MILES Laser TX Missile Cluster (cluster ID: 0x16)
MM-TX Report Messages for Missiles	PRF-PT-00549 & PRF-PT-00635	MILES Transmitter	LTEC	MILES Laser TX Missile Cluster (cluster ID: 0x16)

Message Name (IR Messages) - Sent Out of Band	Source ICD	Sender	Receiver	Comment
NAM-Manual-Association-WPAN-Cmd (0x0098)	PRF-PT-00549 & PRF-PT-00635	IR Programming device	MILES Transmitter (SAT)	Message to manually associate with LPAN parameters such as PAN chan, PAN ID
NAM-Manual-Association-Cmd (0x008A)	PRF-PT-00549 & PRF-PT-00635	IR Programming device	MILES Transmitter (SAT)	Message to manually associate but no LPAN parameters are provided so previous parameters are sent
CC-Client-Configuration-Cmd (0x0006)	PRF-PT-00549 & PRF-PT-00635	IR Programming device	MILES Transmitter (SAT)	To change the detector device type (i.e.: location: left, right, front,rear, top). May use config update above
OPS-Operational-Status-Clear-Cmd (0x0099)	PRF-PT-00549 & PRF-PT-00635	IR Programming device	MILES Transmitter (SAT)	Could be sent over RF or IR (out-of-band) to clear or reset current values being tracked.





LPAN Component Msgs (CKM)



Message Name (LPAN RF Messages)	Minimum Set	LTEC Compliant	Full Compliance	Comment
	Source ICD	Sender	Receiver	
NA-Association-Request (0x0001)	PRF-PT-00549 & PRF-PT-00635	CKM	LTEC	ClientClass: MILES Transmitter, Device Type: Optical Room Indicator, Supported Clusters: NA, MI, BIT, OPS, NAM
NA-Association-Response (0x0002)	PRF-PT-00549 & PRF-PT-00635	LTEC	CKM	
NA-Disassociation-Request (0x0003)	PRF-PT-00549 & PRF-PT-00635	LTEC	CKM	Sends NA-Association-Status-Report as reponse
NA-Association-Status-Request (0x0005)	PRF-PT-00549 & PRF-PT-00635	LTEC	CKM	
NA-Association-Status-Report (0x0004)	PRF-PT-00549 & PRF-PT-00635	CKM	LTEC	Contains network status of device and also sent as response to disassociation request.
NA-Association-Verification-Request (0x0097)	PRF-PT-00549 & PRF-PT-00635	CKM	LTEC	
MI-MILES-Laser-Effects-Cmd (0x0052)	PRF-PT-00549 & PRF-PT-00635	CKM	LTEC	Main CKM message that tells the CKM what serial of MILES codes in the routine to send and at what frequency.
CKM-Configuration-Request (0x00A4)	PRF-PT-00549 & PRF-PT-00636	LTEC	CKM	Use to request the configured location of the CKM.
CKM-Configuration-Report (0x00A5)	PRF-PT-00549 & PRF-PT-00637	CKM	LTEC	Contains the configured location (driver, commander, passenger left, etc.) within the vehicle for a CKM. Should be sent after a request or update.
CKM-Configuration-Update (0x00A6)	PRF-PT-00549 & PRF-PT-00638	LTEC or IR Config Device	CKM	Used to set the location within the vehicle for a CKM.
BIT-Status-Report (0x0012)	PRF-PT-00549 & PRF-PT-00635	CKM	LTEC	Includes battery level.
BIT-Status-Request (0x0013)	PRF-PT-00549 & PRF-PT-00635	LTEC	CKM	CKM needs to respond to the message.
OPS-Operational-Status-Report (0x000B)	PRF-PT-00549 & PRF-PT-00635	CKM	LTEC	Logisitics type info like SW ver, serial #, runtime, # of power cycles, etc. - Don't have to implement runtime and # of power cycles initially only serial # and SW ver.
OPS-Operational-Status-Request (0x000C)	PRF-PT-00549 & PRF-PT-00635	LTEC	CKM	CKM needs to respond to this message.

Message Name (IR Messages) - Sent Out of Band	Source ICD	Sender	Receiver	Comment
NAM-Manual-Association-WPAN-Cmd (0x0098)	PRF-PT-00549 & PRF-PT-00635	IR Programming device	CKM	Message to manually associate with LPAN parameters such as PAN chan, PAN ID
NAM-Manual-Association-Cmd (0x008A)	PRF-PT-00549 & PRF-PT-00635	IR Programming device	Smart User Interface (CIM)	Message to manually associate but no LPAN parameters are provided so previous parameters are sent
OPS-Operational-Status-Clear-Cmd (0x0099)	PRF-PT-00549 & PRF-PT-00635	IR Programming device	Smart User Interface (CIM)	Could be sent over RF or IR (out-of-band) to clear or reset current values being tracked.





LPAN Component Msgs (CIM)



Message Name (LPAN RF Messages)	Minimum Set			Full Compliance	Comment
	Source ICD	Sender	Receiver		
NA-Association-Request (0x0001)	PRF-PT-00549 & PRF-PT-00635	Smart User Interface (CIM)	LTEC		ClientClass: MILES Receiver, Device Type: MILES Detector (left, right, front,rear, or top), Supported Clusters: NA, CC, MD, BIT, OPS, NAM
NA-Association-Response (0x0002)	PRF-PT-00549 & PRF-PT-00635	LTEC	Smart User Interface (CIM)		
NA-Disassociation-Request (0x0003)	PRF-PT-00549 & PRF-PT-00635	LTEC	Smart User Interface (CIM)		Disassociates with server and Sends NA-Association-Status-Report as reponse with new Disassociation State (then leave ZigBee network and coordinator)
NA-Association-Status-Request (0x0005)	PRF-PT-00549 & PRF-PT-00635	LTEC	Smart User Interface (CIM)		
NA-Association-Status-Report (0x0004)	PRF-PT-00549 & PRF-PT-00635	Smart User Interface (CIM)	LTEC		Contains network status of device and also sent as response to disassociation request.
NA-Association-Verification-Request (0x0097)	PRF-PT-00549 & PRF-PT-00635	Smart User Interface (CIM)	LTEC		For devices to verify connection with LTEC server
TES-Entity-Configuration-Status-Request	PRF-PT-00549 & PRF-PT-00635	LTEC	Smart User Interface (CIM)		To disable or enable SAT
TES-Entity-Configuration-Status-Report	PRF-PT-00549 & PRF-PT-00635	Smart User Interface (CIM)	LTEC		Sent by SAT when Rounds are fired (based on configuration of # of round/time in a burst)
TEV-Event-Request	PRF-PT-00549 & PRF-PT-00635	LTEC	Smart User Interface (CIM)		Used by the CIM tp request an event from the LTEC event log (by #, prev, last).
TEV-Event-Report	PRF-PT-00549 & PRF-PT-00635	LTEC	Smart User Interface (CIM)		Used to dry fire the SAT from LTEC or crew UI control.
TEV-Clear-Events-Cmd	PRF-PT-00549 & PRF-PT-00635	Smart User Interface (CIM)	LTEC		Used to clear the events in the LTEC event log.
TES-User-Kill-Acknowledge-Notification	PRF-PT-00549 & PRF-PT-00636	Smart User Interface (CIM)	LTEC		Use to notify LTEC to silence continuous audio after kills.
TES-Entity-Set-PID-Cmd	PRF-PT-00549 & PRF-PT-00637	Smart User Interface (CIM)	LTEC		Used to set the PID in LTEC
TES-Entity-Initialization-Cmd	PRF-PT-00549 & PRF-PT-00638	Smart User Interface (CIM)	LTEC		Used to set the Vehicle type in LTEC
DA-Device-Mode-Change-Cmd	PRF-PT-00549 & PRF-PT-00639	LTEC	Smart User Interface (CIM)		
TEC-Component-Route-Msg-Cmd	PRF-PT-00549 & PRF-PT-00640	Smart User Interface (CIM)	LTEC		Used for the CIM to send a command to another device like a SAT to dry fire.
TEC-Component-Routing-Failure-Report	PRF-PT-00549 & PRF-PT-00641	LTEC	Smart User Interface (CIM)		
TEC-Component-List-Request	PRF-PT-00549 & PRF-PT-00642	Smart User Interface (CIM)	LTEC		Use by the CIM to get the current list of components in the system
TEC-Component-List-Report	PRF-PT-00549 & PRF-PT-00643	LTEC	Smart User Interface (CIM)		Use to provide the CIM with the current list of components in the system
TEC-Remove-Component-Cmd	PRF-PT-00549 & PRF-PT-00644	Smart User Interface (CIM)	LTEC		Use by the CIM to remove a component in the system.
TEC-Component-Status-Request	PRF-PT-00549 & PRF-PT-00645	Smart User Interface (CIM)	LTEC		Use by the CIM to get the component status (BIT & OPS) for a device in the system.
TEC-Component-Status-Report	PRF-PT-00549 & PRF-PT-00646	LTEC	Smart User Interface (CIM)		
BIT-Status-Request (0x0013)	PRF-PT-00549 & PRF-PT-00635	LTEC	Smart User Interface (CIM)		Includes battery level for the device (CIM)
OPS-Operational-Status-Report (0x000B)	PRF-PT-00549 & PRF-PT-00635	Smart User Interface (CIM)	LTEC		Logisitcs type info like SW ver, serial #, runtime, # of power cycles, etc.
OPS-Operational-Status-Request (0x000C)	PRF-PT-00549 & PRF-PT-00635	LTEC	Smart User Interface (CIM)		

Message Name (IR Messages) - Sent Out of Band	Source ICD	Sender	Receiver	Comment
NAM-Manual-Association-WPAN-Cmd (0x0098)	PRF-PT-00549 & PRF-PT-00635	IR Programming device or CIM	Other Device	Message to manually associate with LPAN parameters such as PAN chan, PAN ID
NAM-Manual-Association-Cmd (0x008A)	PRF-PT-00549 & PRF-PT-00635	IR Programming device or CIM	Other Device	Message to manually associate but no LPAN parameters are provided so previous parameters are sent
CC-Client-Configuration-Cmd (0x0006)	PRF-PT-00549 & PRF-PT-00635	IR Programming device or CIM	Other Device	To change the detector device type (i.e.: location: left, right, front,rear, top). May use config update above
OPS-Operational-Status-Clear-Cmd (0x0099)	PRF-PT-00549 & PRF-PT-00635	IR Programming device	Other Device	Could be sent over RF or IR (out-of-band) to clear or reset current values being tracked.





LTEC Performance Statistics



- Windows (Win7 PC –i3 core)
 - Max CPU Utilization: **2%**
 - Memory (RAM): **6 MB**
 - Storage: **25 MB** (executables & data only)
- Linux (TVS VKC – ARM Cortex – 700MHz)
 - Max CPU Utilization: **15-20%** (with Embedded Audio)
 - Memory (RAM used by LTEC) : **8.5 MB**
 - Storage (for LTEC files): **96.5 MB** (executables & data only)
 - Engagement Latency (firing): **25 msec***
 - Assessment Latency (damage assessment): **85 msec***

**Note: Latencies don't include PAN OTA ZigBee message transmission times*





LTEC ECP Test Results



- Occurred mid-Feb 2015 (2 days)
- Tested using Alpha Release 2 of LTEC v1.2
- Results posted on TVS-LTEC Product Page on LT2 Portal
 - <https://www.lt2portal.org/tvs-ltec>
- Identified mixture of **45** LTEC and TVS Component enhancements/issues during TVS ECP testing
- Addressed **20** LTEC specific new capabilities in 1.2 release
 - See LTEC 1.2 SVD for details.
- **17** LTEC enhancements remain for 1.2.1 Patch (June 2015)
- **8** TVS Component SW and HW Issues remain
 - Mainly RF radio, battery charger, and logistics data issues (details to follow)





TVS-LTEC LT2 Portal Page



- Location of data pertaining to TVS LTEC Instance
- Contains the TVS System Composition Agreement (SCA)
- Contains Test Procedures and Results
- Contains LTEC V 1.2 Subversion Patch File for the TVS configuration
 - includes changes to LTEC configuration files for TVS hardware specifics (serial ports, GPIO mapped files, list of services, etc)
- Link: <https://www.lt2portal.org/TVS-LTEC>





LTEC 1.2.1 Patch Update (June 2015)



- **Goals:**

- Complete Issues found from TVS ECP Testing
 - Complete Cheat Kill Detections
 - Missing Visual Kill Indicator, power up kill, etc.
 - Support Optional Detectors
 - Will require update to TVS detectors to support optional flag indicator
 - Chemical Contamination Support
 - Time Sync Support with GPS active
 - Support interface to add required components to the system (i.e. SATs)
 - Will allow dynamic addition of components via user interface (e.g. CIM)
- Add support (LPAN msgs) for Common Power Supply
- Add PK Table updates over IS-TESS Interface
- Define/Prototype OTA Component SW update
- Add Initial VICTORY Data Bus Support





Known Issues with TVS ECP HW



- Device Join announcements not provided for devices connected via relay (SMRFI)
 - Result: LTEC is unable to map unique device addresses for devices connected via SMRFI resulting in duplicate devices on CCM. (Problem related to network stack on VKC radio)
 - Workaround: Don't use the SMRFI (requires removing Cheat Kill as well)
- Message loss when large # of devices connected (6+)
 - Result: Device timeouts and cheat kill due to missing components (Problem related to network stack on VKC radio and CCM radio)
 - Workaround: Disable cheat kill for lost components (see Cheat Kill Svc Config)
- No battery charger driver
 - Result: Unable to determine state of internal VKC battery
 - Workaround: None
- Missing information from some TVS components
 - Result: Missing/wrong logistic info from Detectors, SATs, CCM
 - Workaround: None

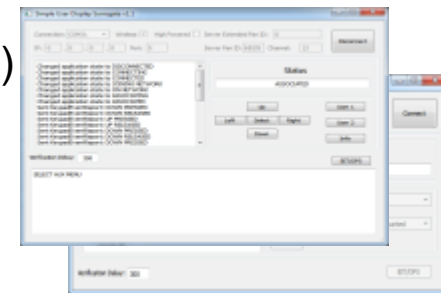




Related Support and Test Tools



- Device Emulation Tool (v18)
 - Supports sending/receiving currently defined LPAN Messages
 - Interfaces with TI CC2531 USB radio module (example code/image available) via the Serial Radio API defined in LTEC ICD (v1.2)
 - Supports Ethernet Sockets and RS-232 LPAN Standard Interfaces
- Example Radio Module Code
 - Implements the Serial Radio API in the LTEC ICD
 - Runs on the CC2531 (could be easily ported to CC2530 chip)
- Example ZigBee Stack Code (ZBOSS)
 - Based on ZBOSS Open Source Implementation
 - Needed when ZigBee Stack not available for selected microcontroller
- Example Windows Based Component Surrogate Apps
 - Weapon Trigger, Simple User Interface, Smart User Interface (CIM)





LTEC Development Governance



- **LTEC is being developed under PM TRADE's CPM program (just like CTIA and other LT2 Components)**
 - Maintained in SVN Repository at the government's IDE Facility
 - Follows CPM processes for updates (CPM Operations Guide)
 - Core Framework & Services Developed and Maintained by CPM Team
 - Updates are managed through CAWG process by creating a Core Assess Change Proposal (CACP) – via LT2 Portal Interface
 - Updates to services require unit test and component agreement updates
 - Service Component Agreements describe service interfaces and data flow
 - Changes/improvements can be proposed and provided by industry
 - Approved changes made by industry will be updated in the common baseline

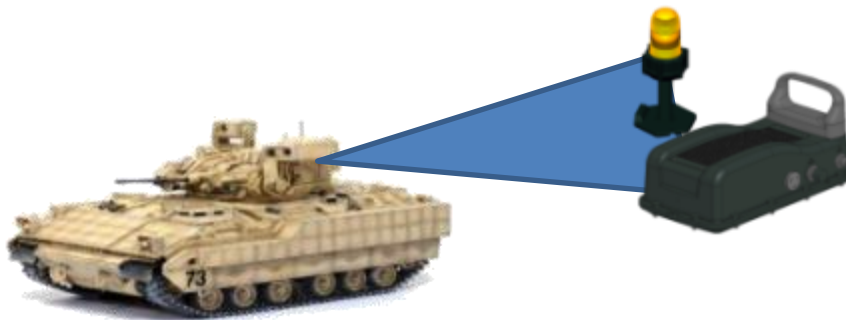




LTEC Vehicle Demonstration



- Demonstrates LTEC running on legacy TVS VKC (Master Controller) HW
- Demonstrates LPAN (ZigBee) Communication with TVS Components
 - VDU (Detector), CCM (UI), SMRFI (RF Repeater)
 - Integration with LPAN compliant IWS SAT or Zeltech LPAN SAT (tentative)
- Integration of Fire Control capability with TVS HW
 - Lockheed Martin updated MILES XXI Components to support LPAN over serial (RS-485)
 - Interfaced FCI (Fire Cntrl Interface), MGLT (Main Gun TX) and VDA (Loader UI) with wireless bridge interface (RS-485 to ZigBee) to provide shooter capability to TVS HW





LPAN/LTEC WG Demonstration



Lockheed Martin MILES XXI Components

MILES XXI components modified to support wired LPAN message format

FCI Trigger Box

Crew Display (LM)

Fire Control Interface (LM)

Main Gun Laser TX (MGLT) (LM)

Generates Wired LPAN compliant Trigger Msg

VDA

RS-485 Bus

Supports Wired LPAN Compliant Laser TX Msgs

Power

RS-485 Bus

RS-485 to Wireless LPAN Bridge

A SBC with USB to RS-485 dongle and USB to ZigBee dongle (CC2531) (SW developed on CPM)

Validates HW Components from various programs & vendors interacting

IS Radio

RS-232

TVS running LTEC/LPAN (Master Controller) with VKI & CCM

SAT (MRLT)

Zeltech

LPAN (ZigBee)

LPAN (ZigBee)

Cubic

IWS SAT

User Interface Display (CCM)

Detector

MILES Control Gun





LTEC Engagement (Fire Ctrl)



MILES XXI Fire Control



Armor Vehicle or FCI Trigger Box



Laser TX



Appended Laser X-mtr

Direct Fire Report Msg (PAN)

Dry Fire Laser Msg & Config (PAN)

LTEC

PAN Weapon Trigger Svc

Weapon Fire Simulator

PAN Fire Stimulator

Training Performance Data (Logging)

TES Entity Persistence

Cue

Embedded Audio Speaker

Embedded Audio Cue

User Interface

PAN Audio Cue

Loader User Display

Audio Intercom

LTEC Core Service

LTEC Device Service

Non-LTEC Device

RemoteDisplay Msg (PAN)

Display Event Msgs (PAN)

Remote Audio Msg (PAN)

TriggerPull Msg (LTEC)
Ammo Selection Msg

Set Laser TX State & PID Msgs (Init)

Qual FireEvent Msg (LTEC)

Fire Report (LTEC)

Entity & Ammo Status (LTEC)

Trigger-Action Msg (PAN)
(Pull/Release, Weapon)
Ammo Sel Msg (PAN)

IS TESS Standard (RS-232)

Appended IS Radio/PU

Surrogate PU (IS-TESS Test-bed)





LT2 LTEC Developers Course



April 1- 2 0830 – 1600

- **Prerequisites**

- ✓ Windows 7 laptop (with DVD/CDROM drive if possible to load training material)
- ✓ Visual Studio 2013 or Express (or gcc 4.4 compiler, e.g. - Mingw or Cygwin)
- ✓ CMake 2.8.12.2 or greater installed and built
- ✓ LTEC 1.2 downloaded, installed and built (if possible) per instructions in the latest LTEC Developer's Guide
- ✓ Latest version of TortoiseSVN that supports at least v1.8 of SVN to install class labs (distributed as patch files)
- ✓ Working knowledge of C/C++ programming

- **Class Size:** Limited to 20 individuals - 2 per company maximum (additional seat requests will be allowed on a space available basis by random selection. (mandatory RSVP by March 20th noon EST) richard.j.lawson.civ@mail.mil

NOTE: A follow-up course is being planned in late June corresponding with the 1.2.1 Patch Release





TVS Kits Overview



Kit contains the following parts:

- 1 VKC – Master controller running LTEC SW
- 8 VDUs – MILES Detectors (uses AA batteries)
- 1 CCM – Crew Control Module (or CIM)
- 1 SMRFI – ZigBee radio repeater
- 1 VKM – Kill Indicator (Strobe)
- Power Cables for VKC & CCM charging

Note: SAT HW not included as part of TVS Kit



- OUM Manual will be available on the LT2 Portal in TVS-LTEC Page
- Kits can be leveraged by
 - Either interfacing your 3rd Party components (like detectors or SATs) with VKC running LTEC 1.2 (can not update LTEC SW)
 - Or interfacing your 3rd Party master controller (running your version of LTEC 1.2 SW) to TVS components in the kit (like the CCM and VDUs)





Check out LTEC TVS Kits



April 2

Request check out of TVS kit which has been modified to work with LTEC.

- Email request to richard.j.lawson.civ@mail.mil, Subject; Loan of LTEC TVS Kit, NLT 31 March 2015
- Kit will be checked out on a lottery basis on 31 March if more vendors want kits than available.
- Kit or software cannot be altered or opened, and will be verified upon return.
(Seals cannot be broken)
- Kit is available for two weeks at a time based on demand.
- The kit must be picked up and returned to Bldg 4, Room 105.
(Visitors Center by Science Gate).
- Transportation (pick-up and return) are the responsibility of the borrowing organization.
- Kit case is 3' x 3' x 1.5' and weighs approximately 100 lbs.
- Coordinate inventory, check out and return with Jose Rodriguez, jose.s.rodriguez20.civ@mail.mil at pH 407-384-3964.





QUESTIONS & WG Feedback





Dial-in and web connect information



GDC4S call in

Connect Web Session: <https://connect.gdc4s.com/garyhall>

Audio: 1-866-441-9660 Meeting ID: 7017



PM TRADE Industry Standards Working Group 31 March – 2 April 2015

Day 2 & 3
LTEC Developers Course &
Component Development
Kit Check Out



PM TRADE LT2 Standards Team
Simulation, Training and
Instrumentation
31 March 2015

